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American Machinist

JULY 5, 1954

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

Production Problems on Supersonic Planes

A SPECIAL REPORT

Hammers for Skyrays—see page 2

HOW TO CALCULATE WORM-THREAD PROFILES

Machine vs. muscle — a duel to the death!

COMPETITION was *mighty* rough on the great Jawn Henry, famed steel-driving rock driller of the last century. For he pitted his strength against a steam-driven drill and *won*—only to die, hours later, from the strain. And the steam drill (later converted to air) replaced all hand methods of drilling rock.

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MAGAZINE OF METALWORKING PRODUCTON

CONTENTS FOR JULY 5, 1954

VOL 98, No. 14

ADMINISTRATION

111 EDITORIAL *Burnham Finney*

145 PATENT PAY *Round Table*

148 HOW TO PASS THE WORD *Theodore A Jackson*

SPECIAL REPORT

129 PRODUCTION PROBLEMS ON SUPERSONIC PLANES *Anderson Ashburn*

ENGINEERING

113 NOMOGRAPH AIDS SOLUTION OF WORM-THREAD PROFILES *Oliver Saari*

118 TITANIUM IS UNORTHODOX WHEN MACHINED *M E Merchant, E J Krabacher, H W Young, J H Miller*

152 FORMULA FOR ELLIPSE LAYOUT *W J Stedman*

MATERIAL CUTTING, FORMING

117 OLD MASTERS' TOUCH SALVAGES SCRAP PARTS

124 AUTOMATIC BRUSHING DEBURRS TURBINE DISKS *R Depastina*

126 THREE SHELL JOBS TYPIFY IRONING OPERATIONS *Stanley R Cope*

146 PRODUCTION METHODS ARE KEY TO IMPROVED BOLT DESIGN *Morris Brenner*

155 REASONS FOR CARBIDE-TOOL FAILURE *W L Kennicott*

TOOLING

122 KNOW YOUR MAGNETIC CHUCKS *Henry Gifford*

149 SIMPLE CONTOUR-MILLING ATTACHMENT *C B Weidner*

150 FLEXIBLE TOOL SUPPORT AIDS CUTTING TAPERED HOLE *J W Wallace*

151 INEXPENSIVE BORING HEAD *H Koslow*

151 SELF-OPENING DIEHEADS CUT THREADING TIME *W D Arnot*

152 SPHERICAL SEATS AID DIE-SPRING APPLICATION *F C Elmo*

152 SIMPLE ROTARY SHEAR ON LATHE *H J Gerber*

NEWS OF METALWORKING

97 SPOT NEWS

99 WASHINGTON

101 DETROIT

103 MACHINE TOOLS

107 GAGING METALWORKING

162 NEWS OF METALWORKING

DEPARTMENTS

90 BACKLASH

149 PRACTICAL IDEAS

155 REFERENCE BOOK SHEETS

161 TALKING SHOP

172 EQUIPMENT, MATERIALS, PARTS

198 ROUND TABLE DISCUSSION

233 NEW BOOKS

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ABC ABP

chips

HAMMER LINE . . . Forming sheet parts to 60 x 96 in. for Douglas F4D *Skyray* and AD *Skyraider* planes, requires a line of 11 Cecostamps at the Torrance, Calif, plant of Douglas' El Segundo Div. Hammers are alined along one wall of the bay with doors opposite each so dies (short runs require frequent changes) can be lined up outside only a few feet from appropriate hammers, moved in by fork truck with minimum delay. Hammers are isolated by mounting on spring-suspended concrete inertia blocks weighing up to 150 tons each. Single pit for mountings is 181 ft long, has cantilevered walls to support fork-truck loads without crosswalls between hammers. Mountings were designed and built by MacIsaac & Menke, Los Angeles.

INDEPENDENCE . . . This issue, dated the day after the Fourth of July, should properly carry some recognition of the day. We provide it in our 16-page Special Report, produced by Special Projects Editor Andy Ashburn as a result of a 5-week, 10,000-mile trip, 1500 miles of it in Southern California alone. It's a well-rounded summary of the production problems on supersonic planes, with solutions to date, based on talks with scores of production executives. The combination of precision, difficult materials, and rigid design requirements has created some posers. We've published articles on many facets, have others in preparation, but this gives you the over-all picture.

WORM PROFILES . . . Right on top of our 8 pages on hobbing worms (June 21 *AM*), we provide a 4-page story, with nomograph and formulas, on calculating exact worm-thread profiles. Oliver Saari of Illinois Tool Works provides data that make it possible to make a hob without profile measurements of a dummy or a master worm. That saves money and time.

MORE TITANIUM . . . Last issue, we summarized E J Krabacher's (see biog) latest work on grinding titanium. Here we provide equivalent material on machining, including charts, photomicrographs, and high-speed-movie frames. These explain why Ti forms unusual chips, calls for unexpected force and power, is likely to cause poor tool life.

TOOLING . . . In addition to other material, you have in this issue two broadly useful tooling articles, one on magnetic chucks by Henry Gifford of Compound Engrg Co, the other on automatic brushing by two Westinghouse engineers.

COMING . . . July 19 *AM* will include an 8-page Special Report on stretch forming, plus a cover and a lead article on making parts for giant presses. There are several short articles, and a 6-page picture story on how Continental produces military engines.

M EUGENE MERCHANT

E J KRABACHER

M EUGENE MERCHANT is a New Englander with his BSME from University of Vermont, plus a co-op graduate scholarship at University of Cincinnati sponsored by Cincinnati Milling Machine Co that gave him his doctorate in physics in 1941. He is now asst director of research at Cincinnati Milling, studying metal cutting, cutting fluids, friction and lubrication. A member of ASM, ASME, ASLE, APS, ACS, and OSA, he has presented many papers. He is a registered professional engineer in Ohio, a Scoutmaster, a member of Phi Beta Kappa, Tau Beta Pi, and Sigma Xi.

E J KRABACHER received his ME from his home-town college, University of Cincinnati, in 1949, after employment by Cincinnati Milling Machine and a hitch in the Air Force. He is now senior research engineer on metal cutting and grinding in the Research Dept. He has authored or coauthored several articles, is a junior member of the ASME, active on ASTM and ASME committees, and a member of Sigma Xi. With Mr Merchant and two associates he prepared our current article on machining titanium.

Before . . . 2 cuts

Now . . . 1 cut

This 6 DP, 28-tooth straight bevel gear formerly required separate roughing and finishing cuts—totaling 19.3 minutes floor to floor time. Now it is completed on the No. 104 Straight Bevel CONIFLEX® Generator in one cut requiring 3.3 minutes —*a production increase of over 500%* with no sacrifice of quality!

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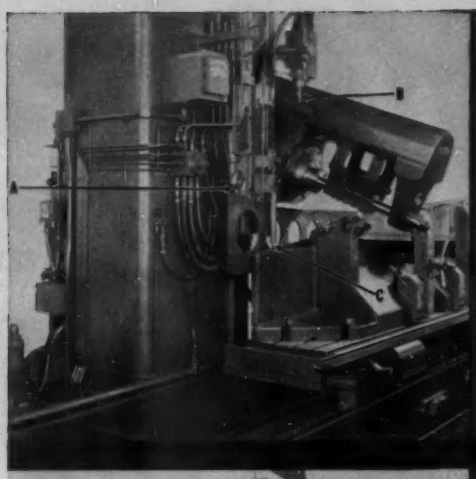
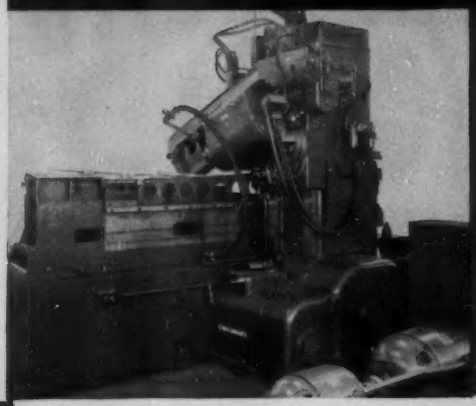
Sections



This view shows the hydraulic tracing units which control the vertical and angular "feed" of the spindle carrier to produce a twist milling operation.



Swivel mounting of the spindle carrier, with its integral motor and hose connections for water cooling, are evident in this illustration.

A manufacturer of aluminum airframe sections wanted a low-cost way to machine a profile with a twist on one edge of the part. Cincinnati Milling was asked to find a solution to the problem, and quickly saw a way to do the job. Cincinnati's engineers recommended a production type milling machine incorporating several units from standard machine tools, including automatic hydraulic tracing control for two feeding motions . . . vertical and angular. The idea was immediately accepted. Two close-up illustrations of the rear of the machine show the principle of operation. As the table traverses, tracing elements "A", "B" and "C" operate simultaneously to automatically control the angular and vertical displacements of the spindle carrier unit, and produce the required profile with a twist on the upper edge of the part. ¶ Automatic hydraulic tracing control is a familiar cost-reducing technique to Cincinnati Milling engineers. They have applied it to Cincinnati Milling Machines in many ways to solve difficult machining operations. These men will be happy to work with you in designing and building machine tool equipment as a complete production package. May we hear from you?

Special Machine Tool Division

THE CINCINNATI MILLING MACHINE CO.

CINCINNATI 9, OHIO

NATI

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to P.D. TEST LIMITS of .0005"— economically
Scale: 1"=1"
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Material 24 St. Aluminum
Number Teeth 468
Outside Diameter 9.7917-9.7897"
Pitch Diameter 9.7500 + .000 — .0005"
Face Width .1875"
Diametral Pitch 48
Pressure Angle 14½°
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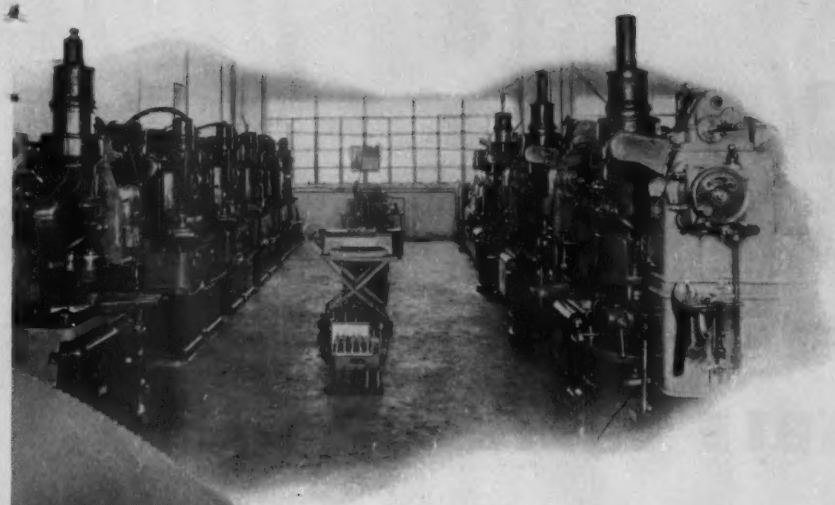
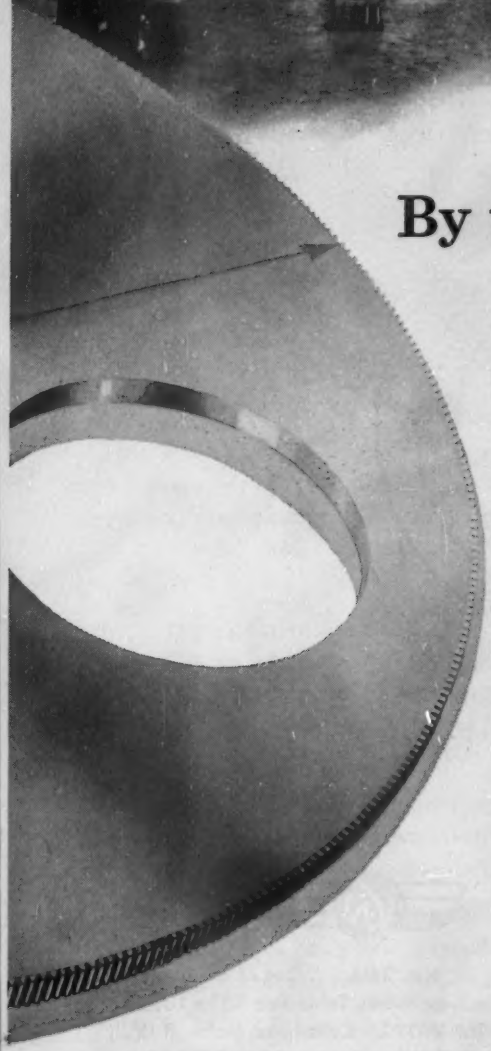
Total Composite Error .0005"
Fellows





By the FELLOWS Method!

A job, most certainly for a super precision gear shop . . . actually from a No. 1 contract gear plant in Florida.* It is shown here because gear men will appreciate the problem of holding .0005" limits on a blank of this size and design.

"CUT ON A FELLOWS 645A3 GEAR SHAPER—SHAVED ON A NO. 12 FELLOWS SHAVING MACHINE" is part of the story. Add the set-up skill of experienced operators as an obviously important contribution. But never overlook the significance of tooling with ORIGINAL FELLOWS CUTTERS and FELLOWS-MADE SHAVING TOOLS.

If you would cut good gears and hold to consistently low costs, draw a Fellows Sales Engineer into consultation. No obligation, of course. Catalogs on request. Address the nearest office.

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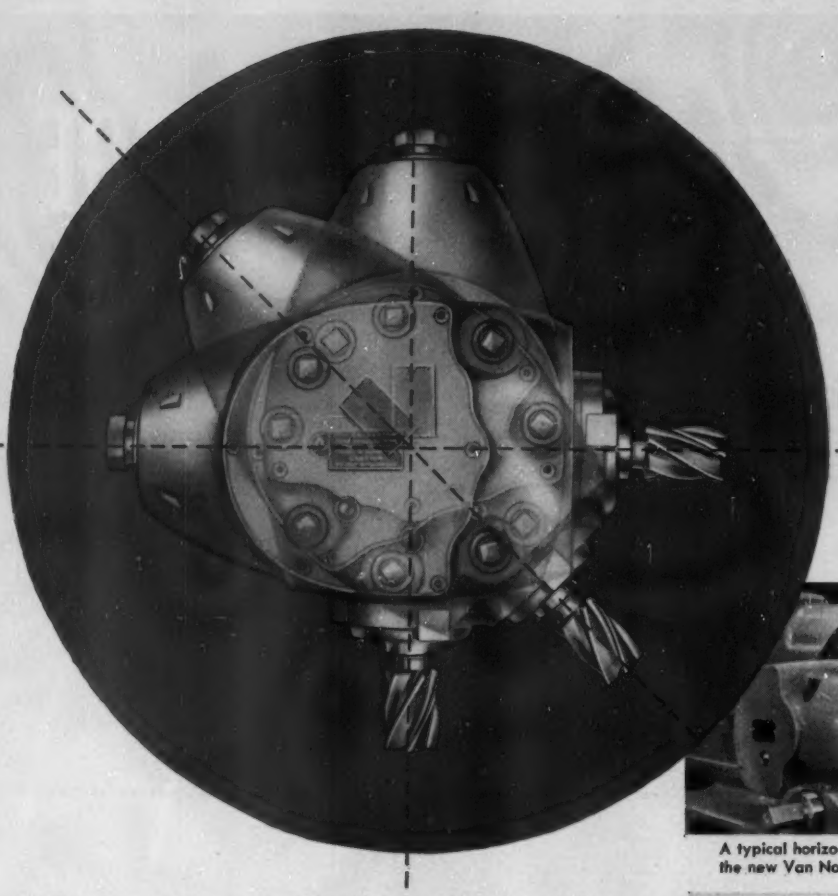
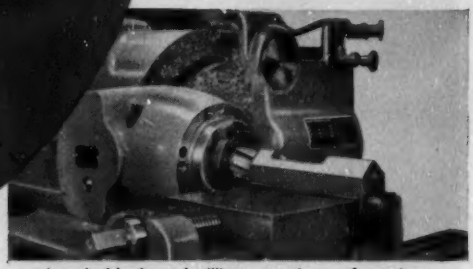




A typical horizontal milling operation performed on the new Van Norman Ram Type Miller.

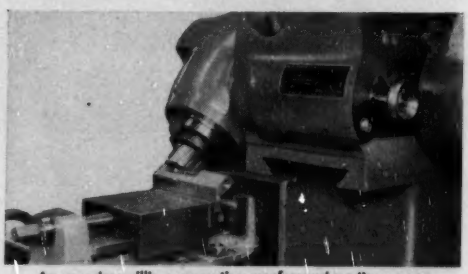
Every one of the *10 new* Van Norman Ram Type Millers give you the operating advantages of extra "*Flex-Ability*" and "*Cut-Ability*" that cut toolroom and production milling costs.

The exclusive adjustable cutterhead, mounted on the heavy-duty movable ram, provides maximum "*Flex-Ability*" . . . enables you to perform horizontal, angular and vertical milling with *one* miller . . . increase the work range that can be handled . . . reduce tooling costs.

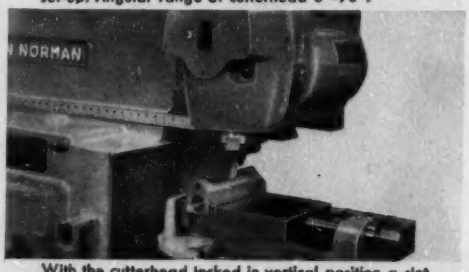
Extra "*Cut-Ability*" is assured through the new heavier columns and bases, larger knee, table and saddle assemblies, extra-heavy gears and spindle motors up to 10 HP.

Production, toolroom, laboratory or job shop . . . you simply can't beat these Van Norman Ram Type Millers for simplified set-ups, tooling and maximum output.

Write, wire or phone for complete details

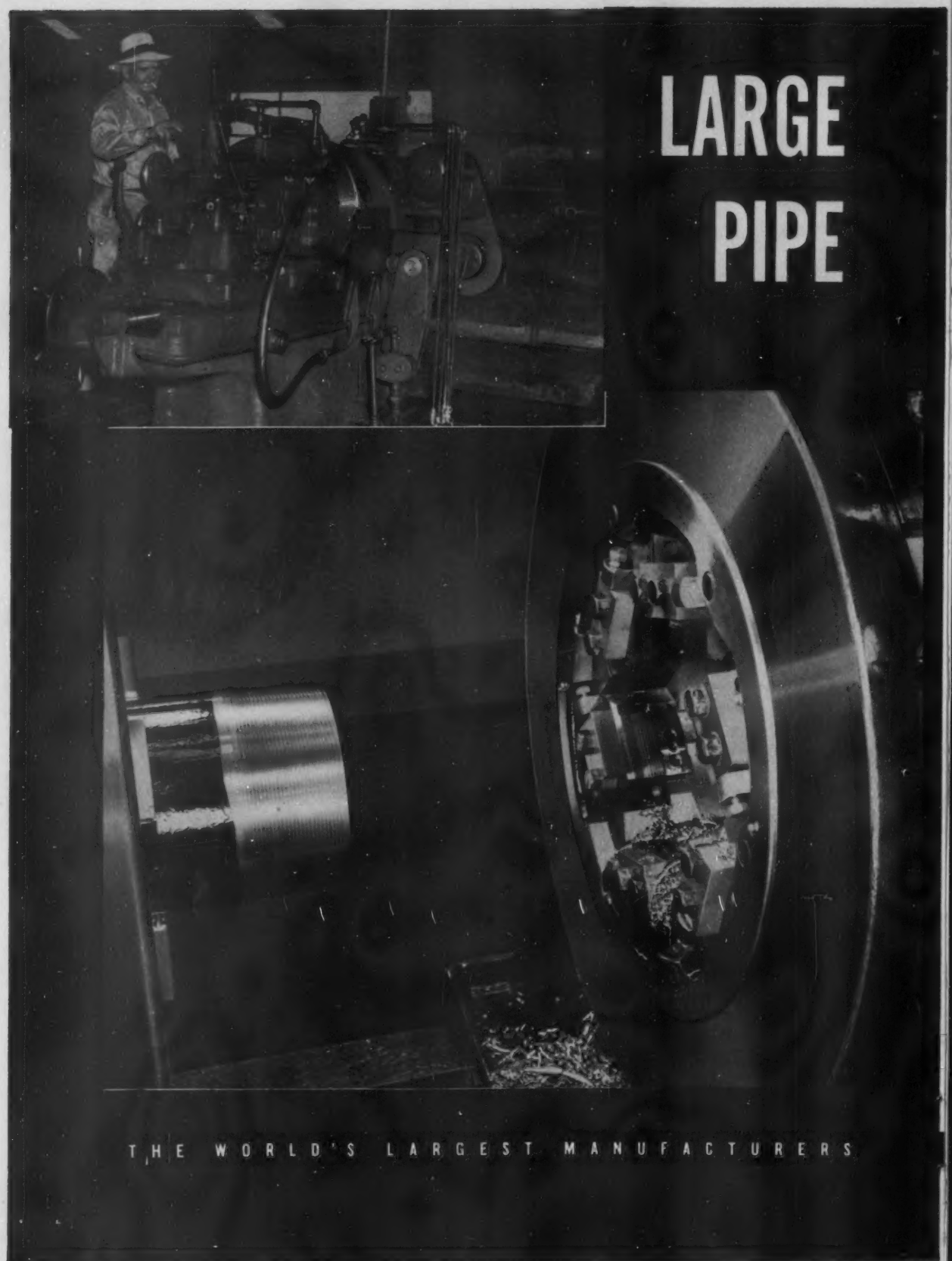


An angular milling operation performed on the same work piece. Note work piece remains in the same set-up. Angular range of cutterhead 0°-90°.



With the cutterhead locked in vertical position a slot is milled in the work piece. Note the set-up has not been changed.

COMPANY | **SPRINGFIELD 7, MASSACHUSETTS**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PIPE
THE WORLD'S LARGEST MANUFACTURERS

TEXAS SHOP USES LANDIS MACHINES *Exclusively*

TEN LANDIS Receding Chaser Pipe Threading Machines are used by Atlas Pipe, Inc., largest mill-type pipe finishers on the Gulf Coast, for threading oil tubular goods.

These machines are installed in an offset position so as to permit uninterrupted production. Typical production figures show: the 4¾" machines threading 74 joints (148 threads) per hour from 2⅜" upset tubing—the 8⅝" machines averaging 20 joints (40 threads) per hour from 5½" casing. All threads are 8 pitch to API standards.

Mr. Becker, Plant Manager, highlights the important production advantages of LANDIS Pipe Machines when he says that they were selected for their flexibility, versatility, and the uniform threads produced. Thread uniformity is made possible by massive construction, leadscrew control of the carriage movement, a precision-built die head featuring LANDIS Tangential Chasers, and an attachment which mechanically controls the degree of taper.

These machines offer flexibility through wide range coverage—three sizes of machines (4¾", 8⅝", 13⅜") thread all pipe sizes from 1⅝" to 13⅜". Ease of set-up is important—a change of diameter and length in less than 2 minutes, a complete change for diameter, pitch, taper, and length in 40 minutes.

LANDIS Receding Pipe Machines perform four other pipe fabricating operations in addition to threading: cutting off, chamfering, reaming, and the making and breaking of collars. For more complete information, please ask for Bulletin C-77.

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Versatility . . . an investment-saving advantage of Landis Universal Cylindrical Grinders

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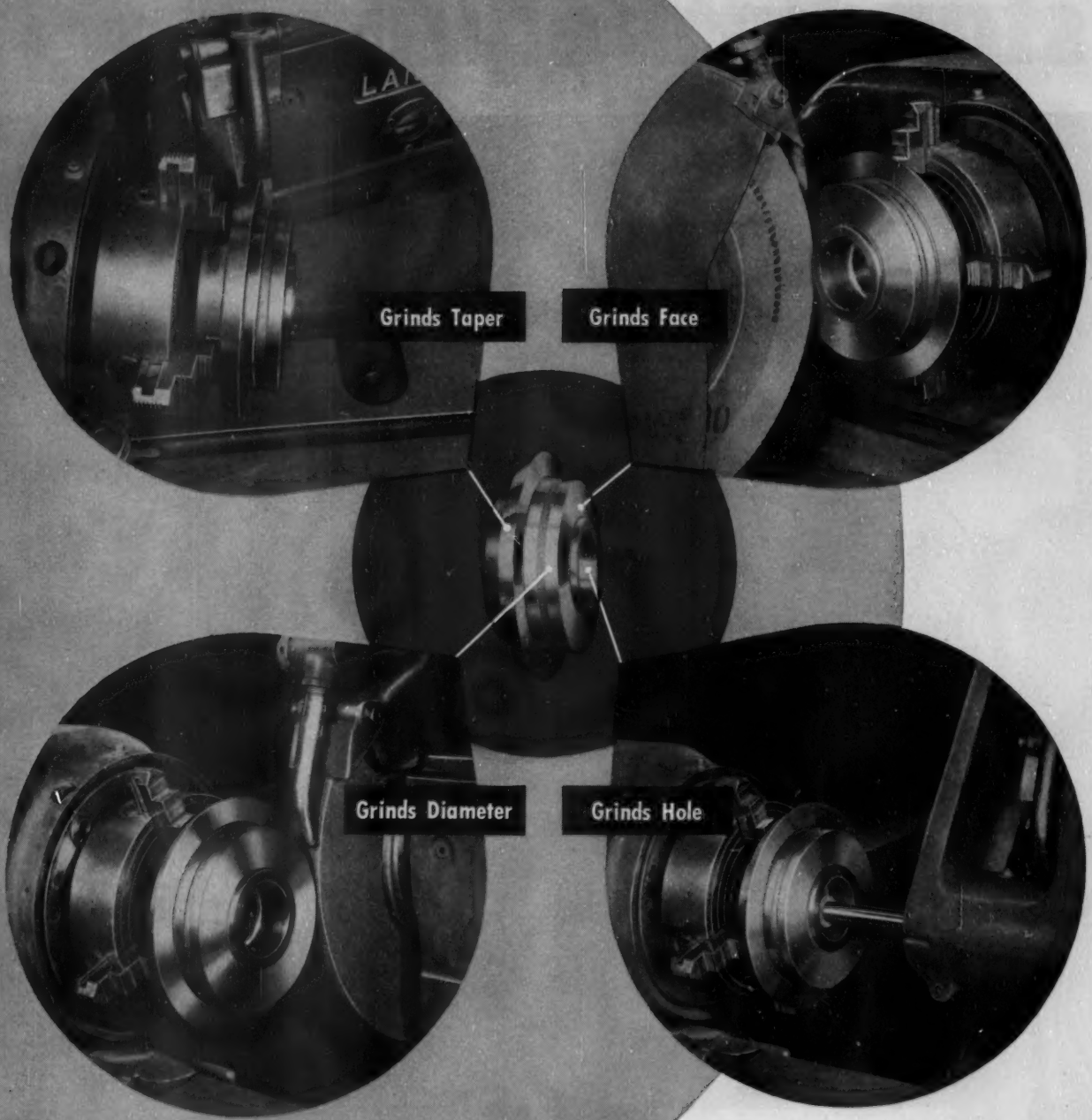

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You get 45 distinct standard equipment

Here's a highly skilled G&L craftsman making final adjustments in the spindle feed gears. All gears have been flame-hardened and precision ground to insure lasting precision... smooth, vibrationless positive power.

spindle speeds as with a G&L 30 Series

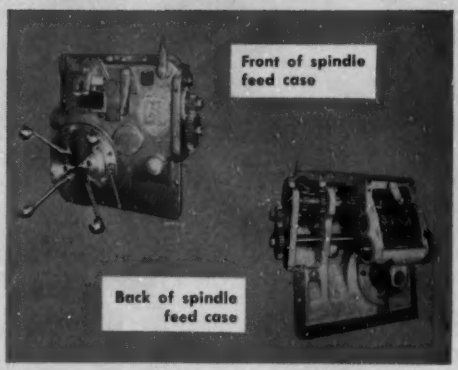
Only a G & L 30 Series table type Horizontal offers so many separate spindle speeds and positive all-geared spindle drive — plus the high torque and full power you need for efficient machining at low or high speeds.

THE engineering of a G&L 30 Series Horizontal Boring, Drilling and Milling Machine's headstock and spindle drive provides a perfectly balanced combination of versatility, efficiency and long-lived precision. With positive all-geared drive — 45 speeds in fine increments — are easy to select or change. Design of the gear train insures high torque at the cutter when working at lower speeds. And — at high speeds — the drive gear shifts and performs with a flywheel effect that provides maximum cutting efficiency of carbide tools. What's more, four gibs on the headstock assure maximum bearing surface, perfect alignment at all times.

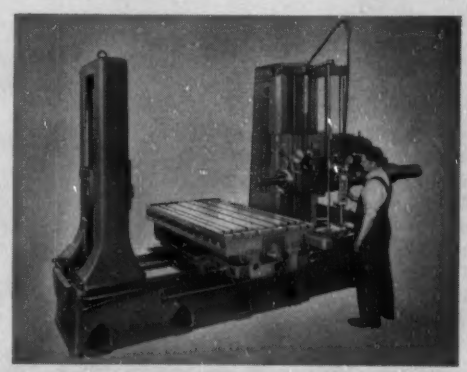
Check these other important advantages

Two of the many other additional advantages you get with a G&L 30 Series are (1) flame hardened and precision-ground bed and saddle ways which are standard equipment and, (2) the option of extended saddle, saddle supports and auxiliary runways which take the risk out of precision machining large workpieces that require the full range of the machine.

Comparing a G&L 30 Series with any other machine in its class — you'll discover that feature for feature, advantage for advantage, you can't buy better. Like all G&L machine tools, the 30 Series has been "often copied, never equaled."



Adjustable micrometer dial graduated in .001" provides fast, accurate spindle positioning. At right, dials beneath cover plate are geared to rotary selectors, show speed or feed engaged. While making selections, operator merely watches window until desired setting appears.



There are two basic models in the 30 Series — the 340-T with 4" spindle and 20 hp, or the 350-T with 5" spindle and 25 hp. Both machines offer a choice of three basic arrangements of table and saddle.

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Builders of the world's finest heavy-duty machine tools — Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; Hypro Double Housing and Openside Planers; Planer Type Milling Machines and Vertical Boring Mills; and Davis Cutting Tools

VK HIGH SPEED STEEL THREAD MEASURING WIRES

...basic tools in a universally accepted method of checking screw threads

VK Set No. 20 HS Thread Measuring Wires, accurate to ±.000025" for 20 common pitch Unified and American screw threads, 6 to 36 threads per inch.

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VK Thread Measuring Wires are made of long-wearing, tough and beautifully finished high speed steel and are either 1⅞" or 2" in length. Every wire is subjected to the closest criteria in today's standards of accuracy.

In addition to set No. 20, shown here, VK furnishes many other standard sets as well as special wires in diameters from .001" to 1.500."

The Van Keuren Catalog and Handbook No. 35 contains 91 pages of technical and engineering information on wire measurement of screw threads. This information, compiled from many years research in the field, is available without charge by addressing: The Van Keuren Co., 173 Waltham St., Watertown, Mass.

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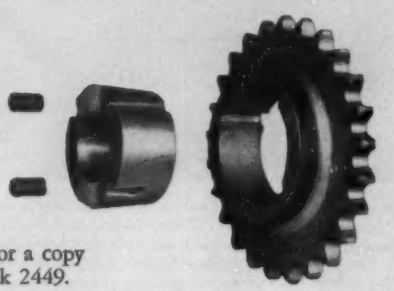

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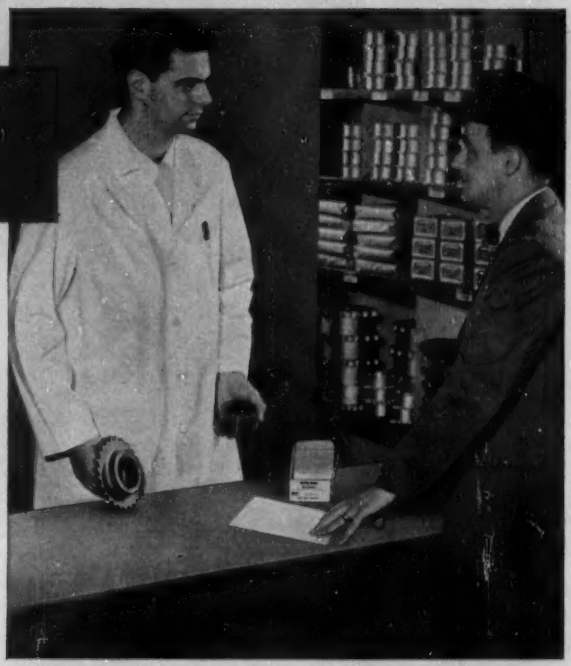
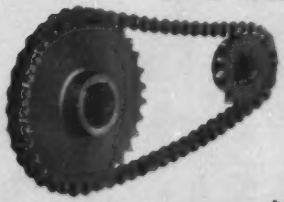
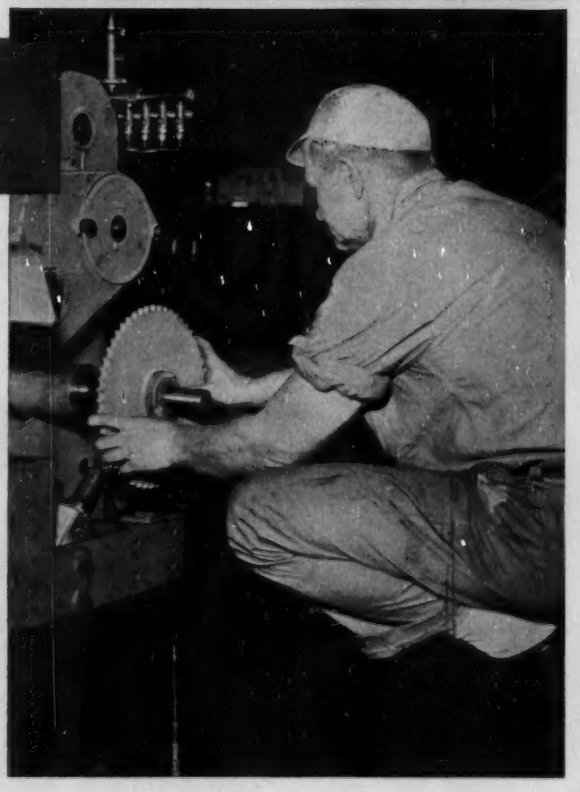


Faster, less expensive installation and removal!

No need to fit sprocket to shaft. Setscrews draw sprocket onto taper bushing, causing bushing to clamp tightly on shaft — equivalent to shrink fit. Turning setscrews in removal-holes quickly releases sprocket from shaft. Full bushing length supports sprocket on shaft.



AN IDEAL COMBINATION:
Link-Belt Precision Steel Roller Chain and Link-Belt Sprockets



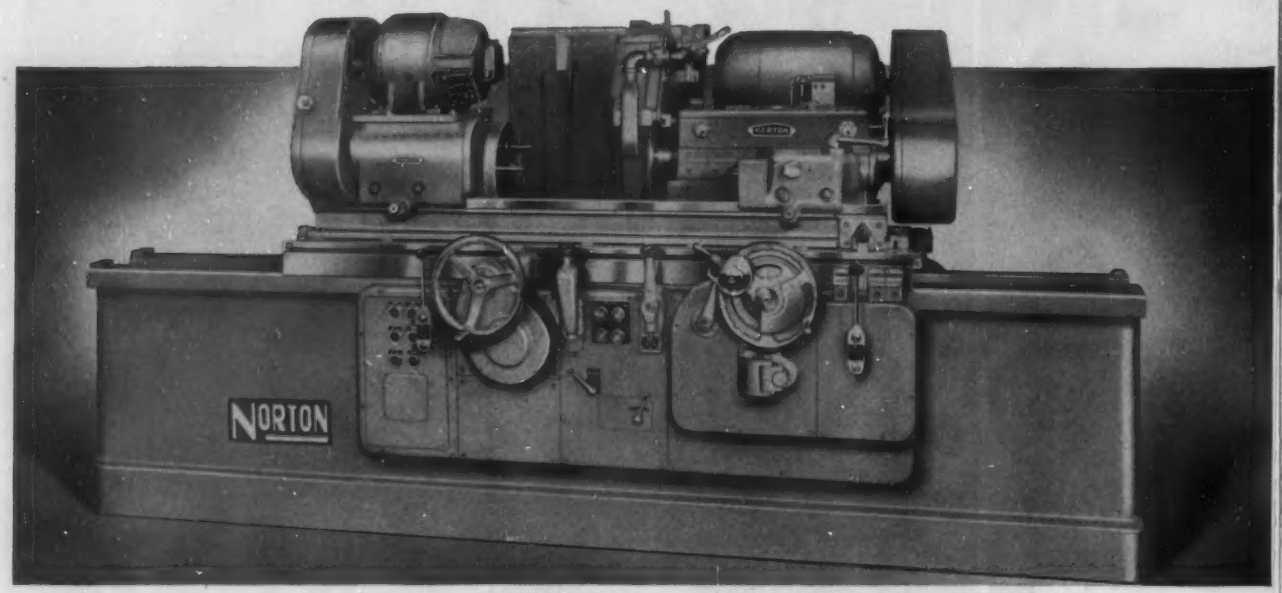
LINK-BELT

ROLLER CHAIN AND SPROCKETS

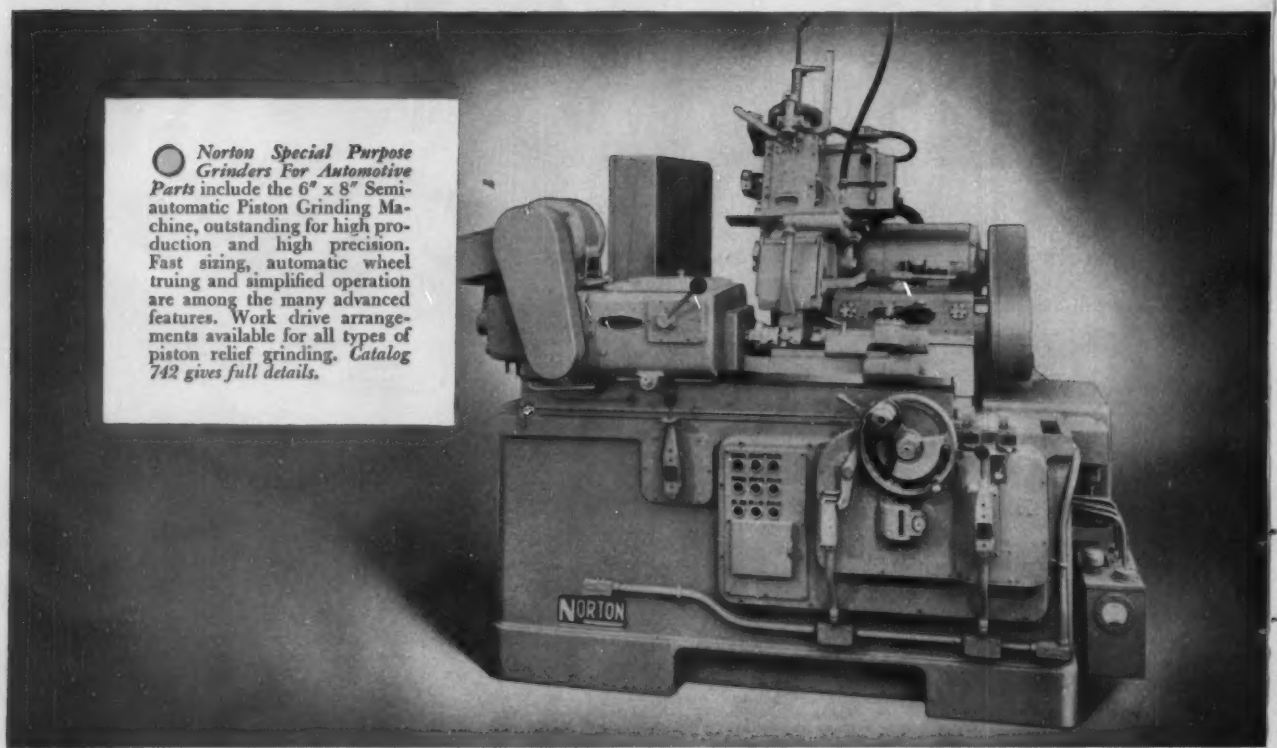
LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

13,507

6 from the world's most



Norton General Purpose Production Type Cylindrical Grinders. The 10" x 36" Type CTU Semi-automatic, a top performer among grinding machines of this type, offers a unique combination of speed, accuracy, flexibility and sturdiness. One-lever control of the automatic grinding cycle reduces operator's duties to loading and unloading. Production line and job shop users report Norton 10" CTU's have doubled production, replaced several machines, eliminated extra operations. *Write for Catalog 1787.*



Norton Special Purpose Grinders For Automotive Parts include the 6" x 8" Semi-automatic Piston Grinding Machine, outstanding for high production and high precision. Fast sizing, automatic wheel truing and simplified operation are among the many advanced features. Work drive arrangements available for all types of piston relief grinding. *Catalog 742 gives full details.*

complete line of

money-saving grinders and lappers

Norton Surface Grinders are well represented by this 8″ x 24″ Hydraulic Grinder. Designed with both hand and power table traverse and cross feed, it produces plane surfaces smoothly and speedily. Convenient controls and easy accessibility keep operating and maintenance times low. Extra equipment, such as magnetic chucks, wet grinding attachment and individual dust exhaust system meet all operating conditions. *Write for Catalog 190.*

Norton Tool Room Cutter Grinders. The No. 20 Cutter and Tool Grinder is the most versatile machine in its class. The wheel head tilts up to 15° above or below horizontal, and may be swivelled through 360° — simplifying such jobs as grinding taper reamers, step counterbores, form tools and milling cutters. Other pace-setting advantages include long table traverse and wheel slide travel . . . integral motor spindle . . . wheel slide graduated dials readable from any angle. No other cutter and tool grinder does so many jobs so fast, so easily. *Catalog 189 tells you why.*

Norton Lapping Machines. The Type 16FC Vertical Lapper brings you outstanding production capacity for such work as diesel injector parts, plug gages, size blocks, sides of small bearing races, pump gears and plates and many other parts. Laps flat work up to 3″ x 5″, and cylindrical work up to 3″ diameter, producing a high degree of accuracy and finish. *Catalog 212 gives you details.*

Only Norton offers you such long experience in both grinding machines and wheels to help you produce more at lower cost.

The six machines shown here are typical products of that experience — bringing you ahead-of-the-parade design that speeds production and adds maximum product-value on every job they do for you.

But remember — these six advanced machines represent only a small fraction of the world's broadest line. Besides many models of cylindrical, surface, crankshaft and camshaft grinding machines, Norton produces a wide range of lapping machines, tool room grinders and special types for grinding pistons, valves, jet parts, etc.

A new illustrated folder #1843 lists the entire Norton line of grinding and lapping machines and tells you how to get all the facts on each unit. For your copy, write to NORTON COMPANY, Machine Division, Worcester 6, Mass. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.

Norton 10″ Universal Grinders. The 10″ x 20″ Universal Grinder has the flexibility to handle an almost endless variety of jobs. Compound swivel arrangement of wheel head enables you to make separate angular settings of wheel and feed. External, internal, face or angular wheel slide operations are easy. Chuck may be mounted on one end of work head spindle, ready for use by turning head 180°. *Write for Catalog 170.*

To Economize, Modernize With NEW

NORTON

GRINDERS and LAPPERS

Making better products . . . to make other products better

District Sales Offices: Worcester • Hartford • New York
Cleveland • Chicago • Detroit

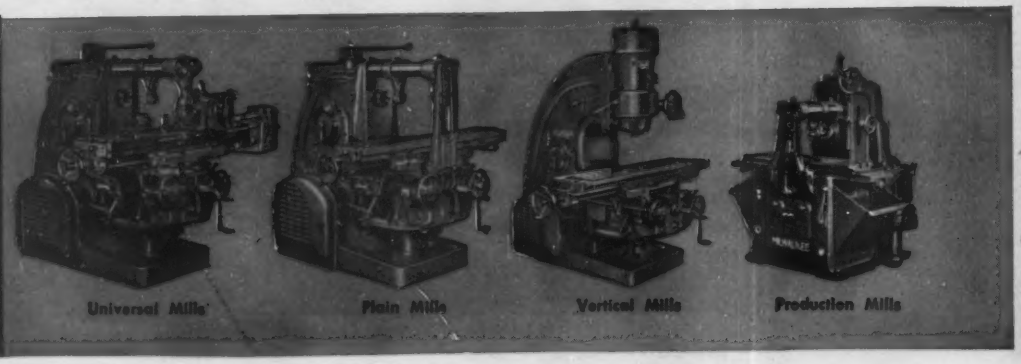
Retooling prohibitive because capital's limited?

use Kearney & Trecker's

TOOL-LEASE PROGRAM

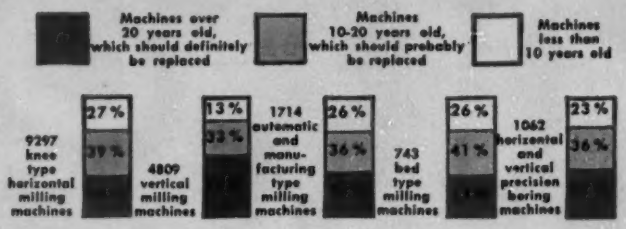
You can meet changing competitive conditions—without a big cash outlay—with new milling and precision boring machines leased from KEARNEY & TRECKER

Kearney & Trecker manufactures a complete line of more than 250 standard knee and bed type milling machines and precision boring machines.



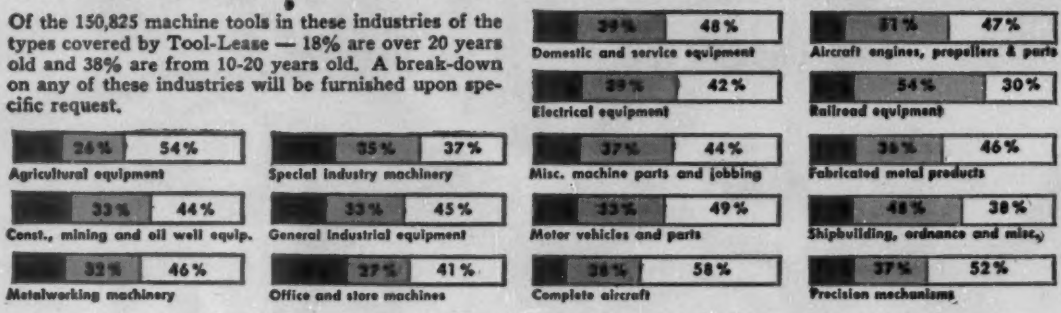
LET'S LOOK AT THE OBSOLESCENCE PICTURE IN THE METALWORKING MACHINERY INDUSTRY

Here's the picture in a typical basic industry — MFG. OF METALWORKING MACHINERY — (see chart at right). Of the 18462 standard knee type horizontal, vertical, bed and manufacturing type milling machines and precision boring machines in use today — *which could be replaced by Tool-Lease* equipment — 32% are 10-20 years old, 22% are more than 20 years old!



HERE'S THE OVERALL PICTURE IN THE ABOVE AND 15 OTHER BASIC INDUSTRIES

Of the 150,825 machine tools in these industries of the types covered by Tool-Lease — 18% are over 20 years old and 38% are from 10-20 years old. A break-down on any of these industries will be furnished upon specific request.


39% 48% Domestic and service equipment
51% 47% Aircraft engines, propellers & parts
39% 42% Electrical equipment
54% 30% Railroad equipment
26% 54% Agricultural equipment
35% 37% Special industry machinery
37% 44% Misc. machine parts and jobbing
38% 46% Fabricated metal products
33% 44% Const., mining and oil well equip.
33% 45% General industrial equipment
35% 49% Motor vehicles and parts
48% 38% Shipbuilding, ordnance and misc.
32% 46% Metalworking machinery
27% 41% Office and store machines
38% 58% Complete aircraft
37% 52% Precision mechanisms

Figures for this presentation adapted from 1953 McGraw-Hill survey of metalworking industry.

BY MODERNIZING WITH TOOL-LEASE YOU CAN ELIMINATE UNNECESSARY OVERHEAD

Kearney & Trecker's Tool-Lease Program offers operating management a quick way to stop the trend of rising costs increasing competition and shrinking profit margins. With Tool-Lease, you can enjoy optimum flexibility to meet changing production requirements while avoiding the risk of high obsolescence. What's more, Tool-Lease enables you to keep your plant modern without tying up working capital.

TOOL-LEASE OFFERS A CHOICE OF PLANS TO MEET INDIVIDUAL NEEDS

Under Tool-Lease, you can rent any of over 250 standard Kearney & Trecker knee or bed type milling machines or precision boring machines. All are available under three basic plans, with varying options to continue or terminate the lease or to purchase the equipment. If you require special machinery or heavy-duty CSM bed types, special agreements will be considered.

GET ALL THE FACTS NOW

For complete information on Tool-Lease . . . help in analyzing your milling and/or precision boring needs — see your Kearney & Trecker representative or mail coupon to Kearney & Trecker Corp., 6784 W. National Avenue, Milwaukee 14, Wisconsin.

TOOL LEASE
KEARNEY & TRECKER
MILWAUKEE
MACHINE TOOLS
EQUIPMENT ®

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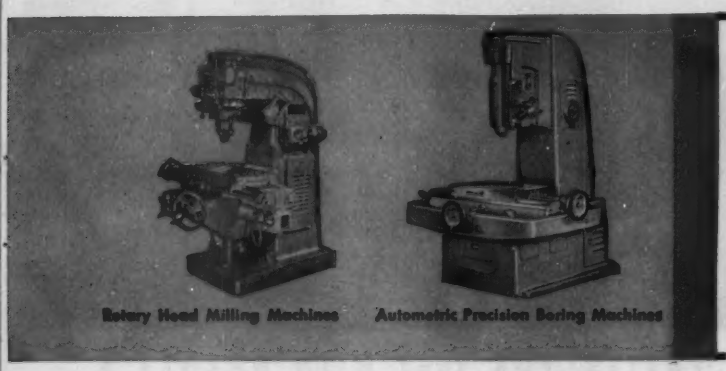


Rotary Head Milling Machines Automatic Precision Boring Machines

KEARNEY & TRECKER CORPORATION
6784 W. National Ave. • Milwaukee 14, Wis.
Please send me Bulletin TL-10A on Tool-Lease Program and booklet titled "Critical Picture of Creeping Obsolescence" or call Milwaukee, GReenfield 6-8300.

Name_____

Title_____

Company_____

Address_____

City_____ Zone_____ State_____

RAM TYPE TURRET LATHES

NO. 2 ALL-GEARED HEAD
1" Bar Capacity
14" Swing

NO. 3 UNIVERSAL
1½" Bar Capacity
15⅜" Swing

NO. 4 UNIVERSAL
2" Bar Capacity
18⅛" Swing

NO. 5 UNIVERSAL
2½" Bar Capacity
20" Swing

SADDLE TYPE TURRET LATHES

1-A UNIVERSAL
HEAVY DUTY
2½" or 3" Bar Capacity
16¼" Swing

2-A UNIVERSAL
HEAVY DUTY
3½" Bar Capacity
20" Swing

3-A UNIVERSAL
HEAVY DUTY
4½" or 6" Bar Capacity
23½" Swing

4-A UNIVERSAL
HEAVY DUTY
8" 9" or 12" Bar Capacity
28¼" Swing

PRECISION TAPPING AND THREADING MACHINES

NO. 10
TAPPING MACHINE
0-80 to 10-24 Capacity

NO. 11
TAPPING MACHINE
8-36 to ⅞" Capacity

NO. 11 RS RADIAL (Single Head)
NO. 11 RD RADIAL (Double Head)
8-36 to ⅞" Capacity

NO. 12
TAPPING MACHINE
¼" to 2½" Capacity

MULTI-SPINDLE AUTOMATICS

6-SPINDLE BAR MACHINE
⅜" to 1⅛" Bar Capacity

5-SPINDLE
CHUCKING MACHINE
6" Swing

5-SPINDLE BAR MACHINE
1¾" Standard Bar Capacity
2¼" Oversize Capacity

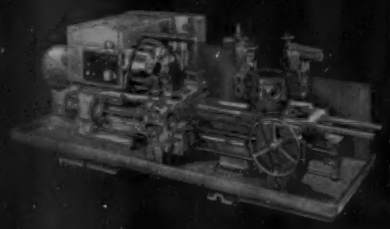
YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS WITH WARNER &

SADDLE TYPE TURRET LATHES

1-A UNIVERSAL
EXTRA HEAVY DUTY
2½" or 3" Bar Capacity
16¼" Swing

2-A UNIVERSAL
EXTRA HEAVY DUTY
3½" or 4½" Bar Capacity
20" Swing

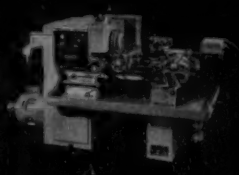
3-A UNIVERSAL
EXTRA HEAVY DUTY
4½" or 6" Bar Capacity
23½" Swing



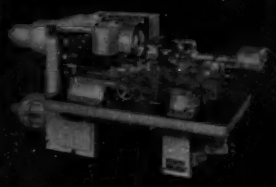
4-A UNIVERSAL
EXTRA HEAVY DUTY
9" or 12" Bar Capacity
28¼" Swing

ELECTRO-CYCLES

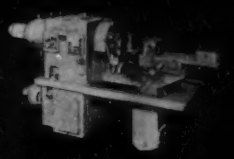
NO. 1 ELECTRO-CYCLE
⅝" Bar Capacity
11" Swing



NO. 2 ELECTRO-CYCLE
1" Bar Capacity
14" Swing



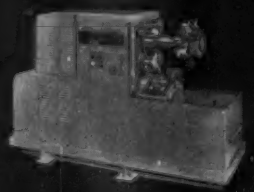
NO. 3 ELECTRO-CYCLE
1½" Bar Capacity
15⅜" Swing



16" ELECTRO-CYCLE
1½" Bar Capacity
16⅞" Swing

SINGLE SPINDLE AUTOMATICS

1 AC CHUCKING MACHINE
8" or 10" Chuck — 6" Working Stroke



2 AC CHUCKING MACHINE
10" or 12" Chuck — 9" Working Stroke

When the going gets tough ...put it on a WARNER & SWASEY

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

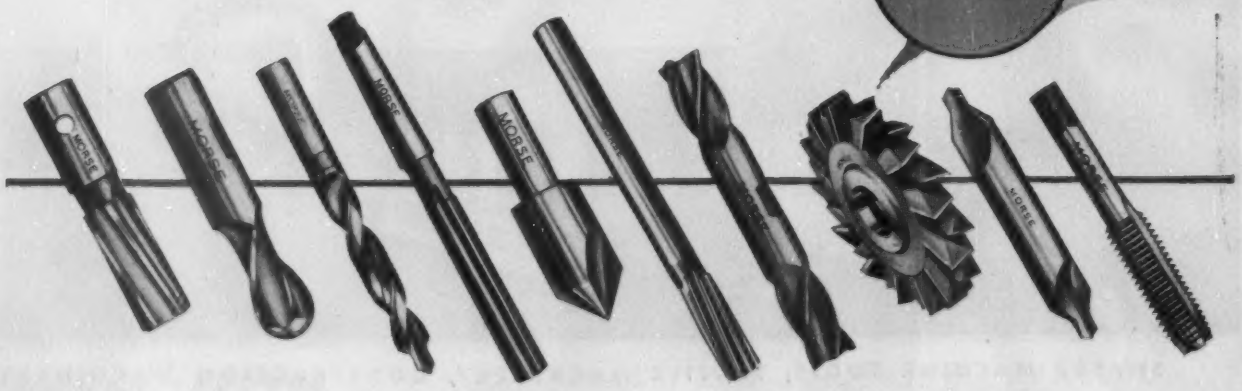
SWASEY MACHINE TOOLS, TEXTILE MACHINERY, CONSTRUCTION MACHINERY

You get
"National Network Service"
when you hook up with a
Morse-Franchised Distributor

The five Morse warehouses are linked together with the Morse plant in a complete teletype network, coast to coast. And this instant, constant communication means that your Morse-Franchised Distributor is able to give you top-speed service no matter what your cutting-tool needs may be at any moment . . . and no matter whether the particular tools you need are available right at that moment at any single stock-point. He knows how to find them fast, and get them to you "quickest way". And that goes for the complete line of the finest cutting tools made . . . Morse Drills, Taps, Dies, Reamers, End Mills, Counterbores and Milling Cutters. *So always call your Morse-Franchised Distributor.*

MORSE TWIST DRILL & MACHINE COMPANY
NEW BEDFORD, MASSACHUSETTS
(Division of VAN NORMAN CO.)
Warehouses in New York, Chicago, Detroit, Houston, San Francisco

San Francisco
TWX No. SF-1068



— MORSE

Cutting Tools

Buy them by phone from your Morse-Franchised Distributor and save ordering time

NOW!

Cincinnati Grinding Wheels offer

PD POSITIVE DUPLICATION

The CINCINNATI (PD) Manufacturing Process is the greatest grinding wheel development in years—an achievement in precision manufacturing and quality control that means a brighter working picture for you.

Through the CINCINNATI (PD) Manufacturing Process, you can be *positive* that *every* CINCINNATI (PD) Wheel you order will be produced exactly to the Cincinnati grading specified for your job.

And, just as a negative guarantees exact duplication of a photograph, the CINCINNATI (PD) Manufacturing Process assures a POSITIVE DUPLICATION of the original wheel EVERY time you reorder.

The problem of duplication has been a major concern of Cincinnati Milling throughout its 30 years of practical experience in using grinding wheels, and in supplying industry with precision grinding machines equipped with grinding wheels and ready for production operation. Cincinnati Milling found that once the right grinding wheel had been specified for a particular job, sometimes it was difficult to secure additional wheels of identical grading that would duplicate the performance of the original wheel. The need for positive duplication in the manufacture of grinding wheels is of utmost importance not only to Cincinnati Milling, but to every user of grinding wheels.

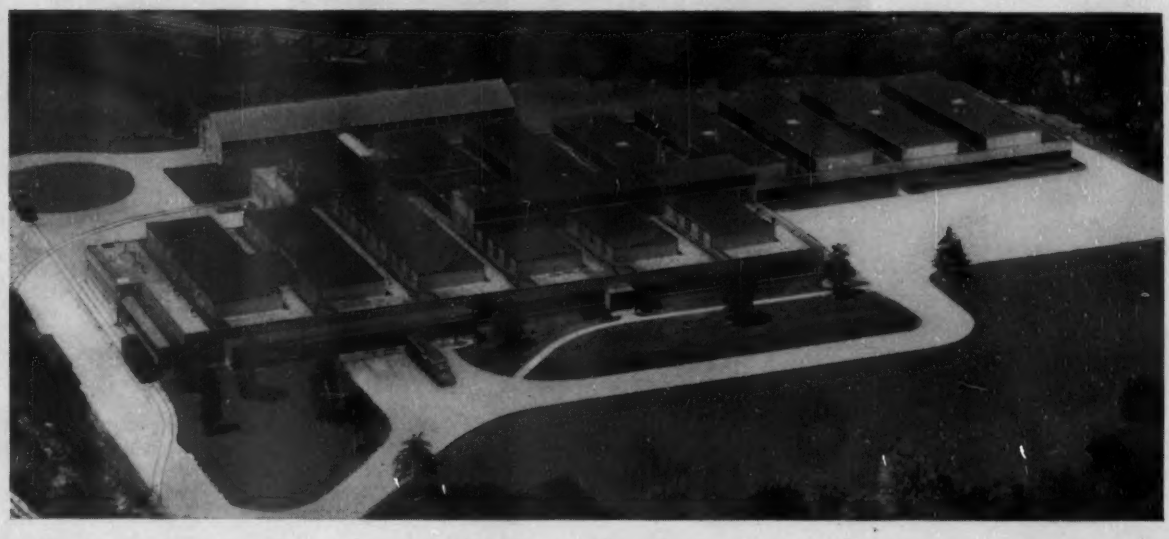
Positive Duplication (PD) is the result of extensive manufacturing research which revealed that *several steps* in the production of grinding wheels generally considered as unimportant, were quite to the contrary, *extremely important.* As one step toward (PD) Wheels, Cincinnati Milling constructed the world's most modern, most completely equipped grinding wheel plant. Some of the equipment installed has never before been used by the industry in the manufacture of grinding wheels.

Then, to make (PD) Wheels an actuality, Cincinnati Milling developed new standards of manufacture with 36 quality control steps. From the weighing of the grain and bonding material, through molding, drying, firing, finishing, to final inspection, every operation is

carried out with the same exactness as in building a precision machine tool.

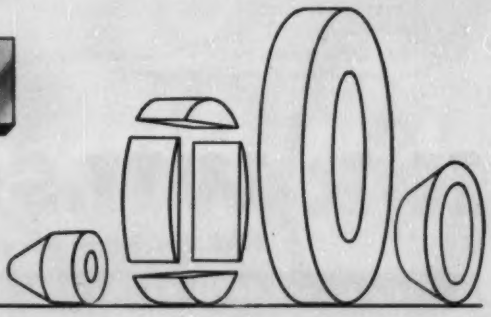
You're assured a POSITIVE DUPLICATION of the original wheel EVERY time you reorder. "On grade" with a CINCINNATI (PD) Wheel means all future (PD) wheels will act and grind exactly alike. For you, this means *no more* production interruptions which cut output and increase your costs.

Let us prove to you how CINCINNATI (PD) Wheels will make money for you. Just contact us and we'll send one of our representatives—men who know grinding and grinding machines as well as grinding wheels. Write, wire or 'phone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.



The CINCINNATI (PD) Manufacturing Process was made possible by this plant—the world's most modern grinding wheel plant.

CINCINNATI
Grinding Wheels
THE CINCINNATI MILLING MACHINE CO.
Cincinnati 9, Ohio



VERSATILITY

..a big word at LANCASTER MALLEABLES

Another on-the-spot photo of a KRW Hydraulic Press in action

only KRW gives you all this!

- **HEAVY CONSTRUCTION THROUGHOUT** — Bed and crown members are truss-reinforced for added stiffness and strength. A KRW exclusive feature.
- **SELECT YOUR PRESSURE** — Required tonnage pressure up to rated capacity can be quickly obtained and locked for repetitive operations.
- **ONE SWINGING BALL ARM** — Controls downward motion of ram, holds pressure on work, or returns ram.
- **ACCURATE "INCHING" OF RAM** — Motor runs only when ball arm is moved for downward ram travel.
- **SPRING RETURN OF RAM** — Gives maximum speed on upstroke.
- **HIGHEST QUALITY** — Radial type Hydraulic pump.
- **DIRECT CONNECTED** — Motor drive through flexible coupling.
- **TWO SPEED HAND PUMP** — Also furnished on motor driven presses in this series.

. . . so they chose the most versatile press they could find!

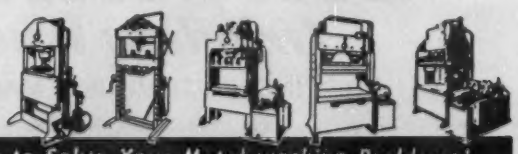
Lancaster Malleables & Steel Co. makes so many different castings for so many different companies that their choice of a Hydraulic Press for straightening work was a mighty important one. They might have a run of locomotive brake ends, parts for pneumatic tools, automobile jacks, and rear end tractor housings all in one day and they needed a press that could keep pace. We showed them how fast a KRW motor-driven Hydraulic Press converts from one set-up to another — almost before you can say Lancaster Malleables and Steel Co. — and they were sold. Lancaster officials tell us this press is adding to its reputation for speed, accuracy and versatility every day.

WRITE FOR FACTS

You too will save time and cut costs with a KRW Hydraulic Press. Note carefully the features at the left. You get them only from KRW. We make a full line of one, two and three cylinder Hydraulic Presses; 25-150 ton capacities; hand, air or motor driven. Check with your Machinery dealer or write us for full facts and prices.

K·R·WILSON

210 Mill Street, Arcade, N. Y.



Designers and Builders of the Right Hydraulic Press to Solve Your Metal-working Problems!

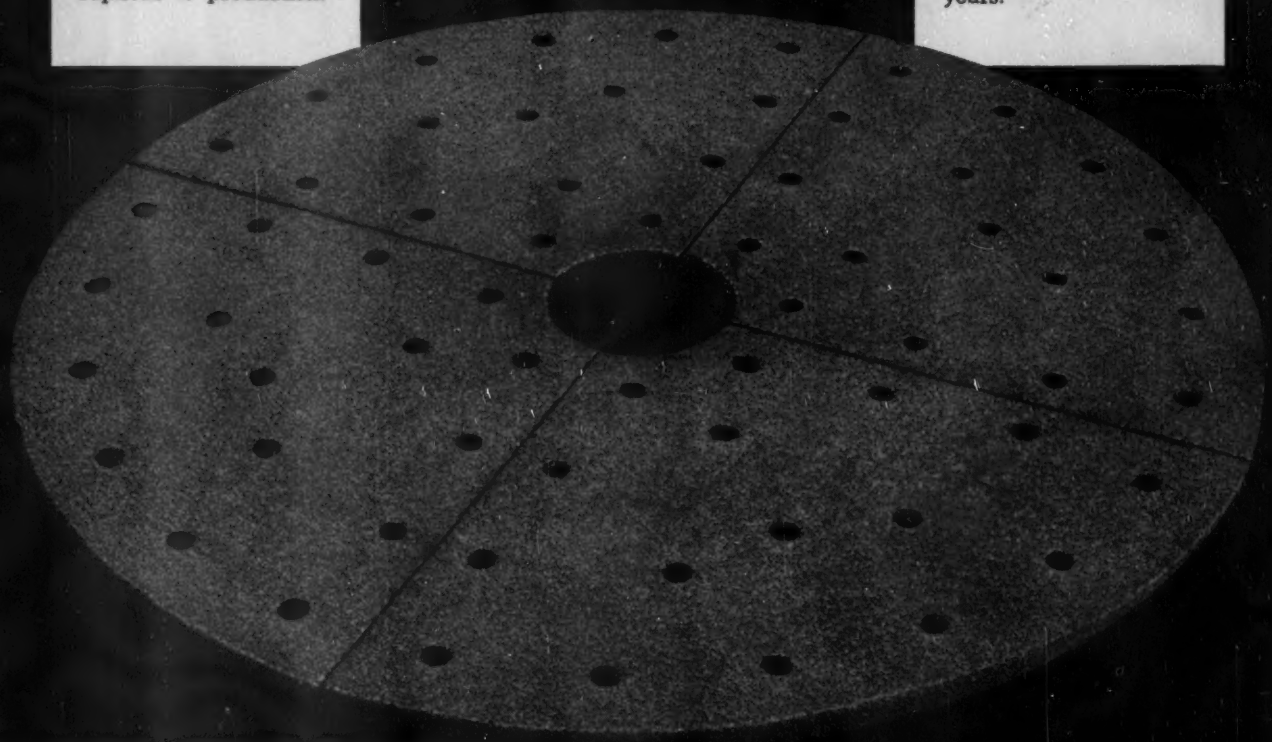
HOW A HARDER GRADE ABRASIVE INCREASED DISC LIFE 10 TIMES

The Problem

An ordinary type of segmental disc had to be replaced after snag grinding only 51,000 automobile cylinder blocks on a Gardner Horizontal Disc Grinder. The short disc life caused high abrasive costs and interruptions to production.

The Solution

The Gardner Abrasive Specialist recommended a YELLOW-RIM segmental disc of a much harder grade. This new disc has already ground more than 250,000 cylinder blocks and is expected to grind 250,000 more in the next two years.



If you encounter problems in flat surface grinding Gardner Abrasive Specialists can help you solve them. They have experience gained from making both the grinding machines and the abrasive discs.

For help with *your* grinding problems, consult the Gardner Abrasive Man.

GARDNER MACHINE COMPANY
410 Gardner St., Beloit, Wisconsin, U. S. A.

GARDNER
abrasive discs

New Norton Cut-Off Wheels Get Industry's O.K.!

Reports from every section of the country tell how the freer cutting, longer lasting R50 and B9 add the profit-boosting "TOUCH of GOLD"

Here's what they say about—

The R50

143 more cuts
Job: California mine bit manufacturer, cutting nickel steel stock 2⅞" x ½" cross-section on automatic machines.

Report: R50 rubber cut-off wheel best ever used. Gave 735 cuts to competitive wheel's 592, for 24% more wheel life.

Better performance
Job: Connecticut machine tool manufacturer, cutting various types and sizes of steel. (Illustrated, opposite page.)

Report: R50 wheel outperformed competitive wheel on wet cutting of high carbon tool steel, with freer cutting action and a square cut.

120% longer life
Job: Indiana construction equipment manufacturer cutting steel bar stock and tubing.

Report: R50 wheel produced 216 cuts, 120% more than competitive wheel's 98 cuts.

No burn or breakage
Job: Kentucky manufacturer of garbage disposal units, cutting chrome vanadium steel, ⅝" x ¾" cross-section.

Report: R50 wheels eliminated the breakage problem and produced a cut free of burr and burn.

450 more cuts
Job: Missouri manufacturer of coal mining equipment, cutting mine bit bar stock.

Report: R50 handled 12 bars at 90 cuts per bar, totalling 1080 cuts. Beat best previous wheel's record of 7 bars, 630 cuts, by 70%.

Freer cutting, longer lasting
Job: Massachusetts manufacturer of pneumatic tools cutting 1⅛" hexagonal drill rod steel.

Report: R50 wheel proved to be 25% more durable while producing an equal quality of cut. Freer cutting, with less of usual rubber wheel odor.

25% more cuts
Job: Connecticut machine manufacturer, cutting miscellaneous steel stock.

Report: R50 wheel produced 25% more cuts than competitive wheels with equal freeness and cleanness of cut.

The B9

72% more durable
Job: Michigan engine manufacturer, cutting crankshaft spindle arms.

Report: B9 wheel produced 250 cuts over competition's 145, lasting 72% longer on this job.

Lasted three times longer
Job: Ohio metal working company, cutting miscellaneous steel bar stock.

Report: B9 gave this user three times the service life of competitive wheel, with excellent cutting performance.

40% more cuts
Job: Pennsylvania die manufacturer, cutting carbon steel bar stock ½" x 3" cross-section.

Report: B9 wheel out-produced competitive wheel by 40% giving 252 cuts as against 180.

36% production increase
Job: Missouri metal company, cutting heavy wall pipe, 3½" O.D. — 2½" I.D.

Report: B9 gave 75 cuts to competition's 50-55, proving 36% longer lasting.

Best wheel ever used
Job: Michigan tool manufacturer, cutting mild steel shank stock.

Report: B9 produced twice the number of pieces previously cut, rated best wheel ever used on this job.

150% over competition
Job: Maryland metal working company, cutting miscellaneous bar stock.

Report: B9 wheel gave 125 cuts, topping competitive wheel's 50 cuts by 150%.

42% more cuts
Job: Pennsylvania construction equipment manufacturer, cutting 1⅛" high carbon drill rod.

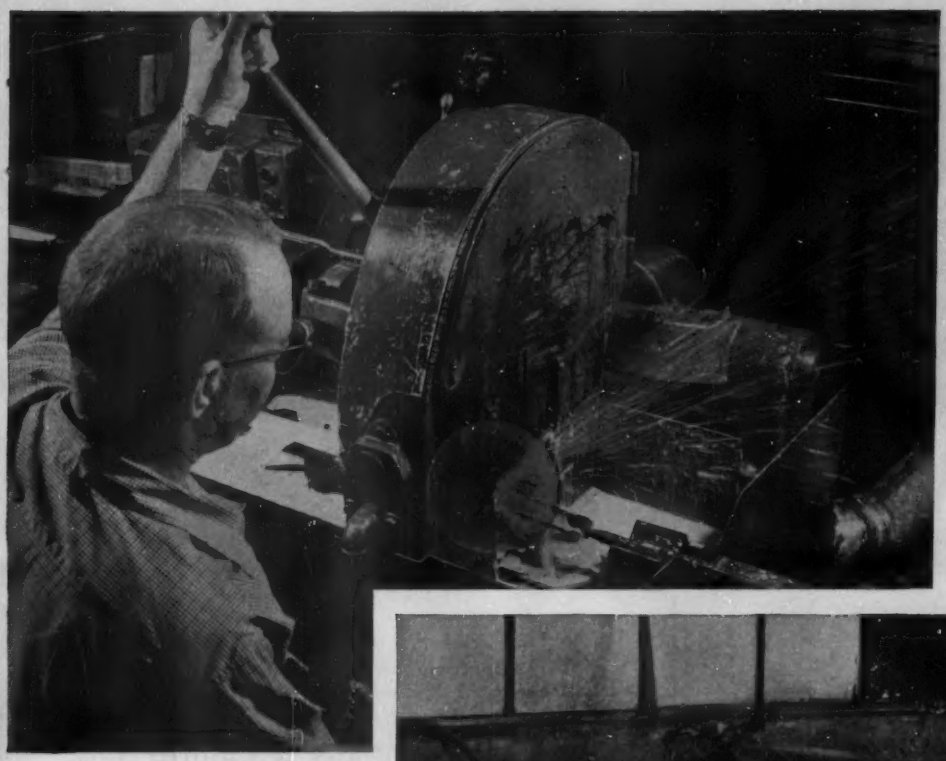
Report: B9 averaged 125 cuts, 42% over competition's average of 88 cuts.

85% longer life
Job: California forge and pipe foundry, cutting spiral welded pipe.

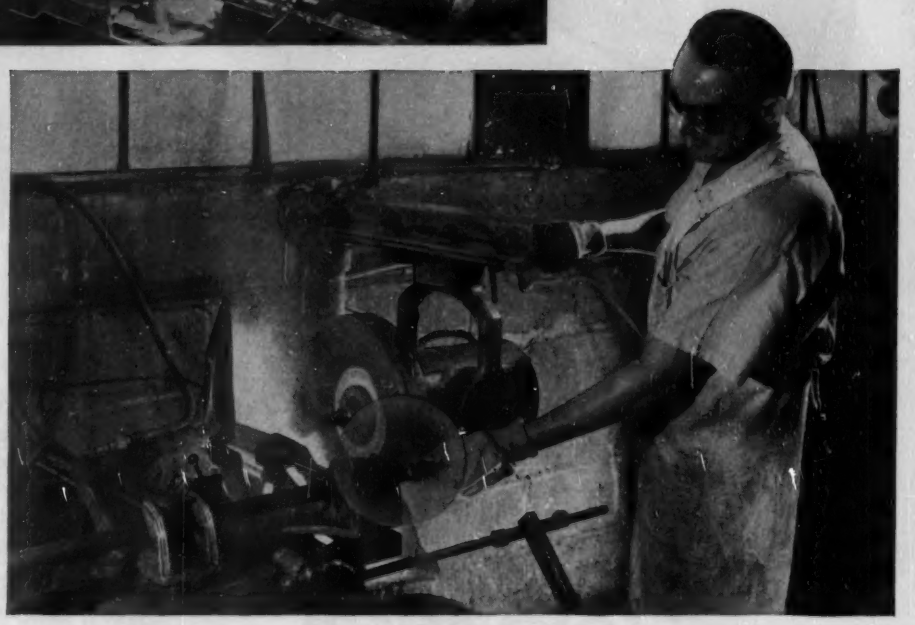
Report: B9 lasted 85% longer than any other wheel.

27% more durable
Job: Ohio aircraft manufacturer, cutting a wide variety of bar stock. (Illustrated, opposite page.)

Report: B9 wheel delivered 27% longer life than competition, with faster cutting action and improved quality of cut.



The New Norton R50 rubber bonded cut-off wheel is designed especially for wet-cutting of ferrous or non-ferrous bar stock up to 6" diameter. Built-in chip clearance — a great advancement in this type of wheel — is one of its special "Touch of Gold" advantages that assure freer, faster cutting with maximum strength and service life.



The New Norton B9 resinoid bonded cut-off wheel is made with either smooth sides or with the rough "F" sides for more clearance in the cut. It is a high production wheel, cutting free and cool with minimum burning. It will give you long, economical "Touch of Gold" performance in the widest range of ferrous and non-ferrous applications.

Performance reports like these are coming in every day telling how the new Norton R50 and B9 cut-off wheels are setting new records for extra long service life and improved cutting action. Check them carefully, then judge for yourself how much your own cutting-off operations will benefit by these outstanding wheels. And remember: for every cut-off job you do, there's a Norton cut-off wheel that will add the money-saving "Touch of Gold."

See Your Norton Distributor for the cut-off wheels you need. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed under "Grinding Wheels" in your classified phone directory. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts. W-1568

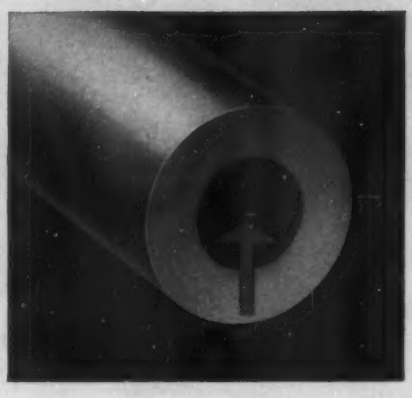
Making better products . . . to make other products better

NORTON

and its BEHR-MANNING division

NORTON: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING: Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes

a hole here makes waste...



a hole here makes a saving

Crucible Hollow Tool Steel Bars **are a boon to the metalworking industry. The hole in these quality bars enable toolmakers to eliminate drilling, boring, cutting-off and rough-facing operations. This cuts production time, boosts machine capacity and saves scrap losses.**

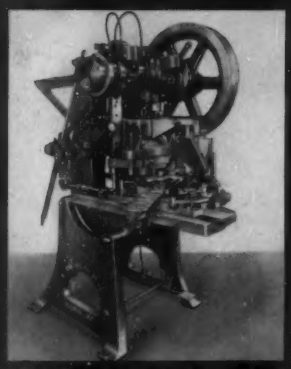
They are available now, in any of Crucible's famous tool steel grades, in almost any combination of O.D. and I.D. sizes. And you can get *immediate* delivery of five popular grades — KETOS oil-hardening, SANDERSON water-hardening, AIRDI 150 high carbon-high chromium, AIRKOOL air-hardening, and NU DIE V hot-work tool steels — from a conveniently located Crucible branch warehouse.

Let your Crucible representative show you how these steels can best help *you*.

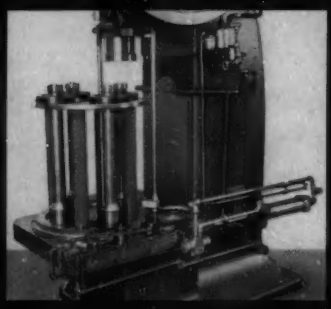
CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking **HOLLOW TOOL STEEL**

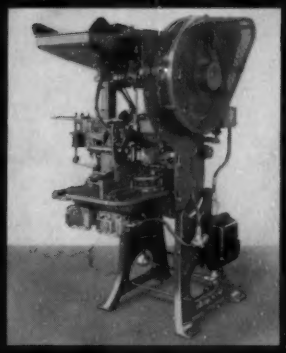
CRUCIBLE STEEL COMPANY OF AMERICA • TOOL STEEL SALES • SYRACUSE, N. Y.



V & O has the sturdiness that makes automation practical.



V & O can provide the working height that automation may need.



V & O has the precision that is fundamental to automation.

If made on a standardized assembly line, the mere changing of a few bolt sizes can cause a press to become a "special job." But if made in the V & O shop the most extraordinary of press automation features are just part of the day's work.

V & O was started, 65 years ago, to eliminate the problems of automated press tooling. Our long slide principle, the greatest boon to press automation, was built into the first press we ever made. We have lived with automation, worked with automation, dreamed out the answers to automation problems, for all those years. And there is no such thing as an automated press that does not have special features.

When you have a production problem that can be solved by automated tooling, automated feeds, higher precision tool motions, or tools whose lives depend upon the precision with which the press operates, take it up with V & O.

When you want the press that will be easiest for your own tool makers to automate, be sure that you get a V & O.

Our representative would like to tell you more about the press that is built like a high grade machine tool. Write us, please.

HOW SPECIAL IS A "SPECIAL" MACHINE?

THE V & O PRESS COMPANY

DIVISION OF EMHART MFG. CO.

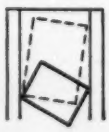
HUDSON, NEW YORK

BUILDERS OF PRECISION POWER PRESSES AND FEEDS SINCE 1889

65th Anniversary

WHY THE V & O LONG SLIDE PROVIDES BETTER ALIGNMENT

With the same running clearance, the longer the slide the less the possibility for angular misalignment. And we keep our running clearances very close indeed.



LaGuardia Airport

The Port of New York Authority Photo

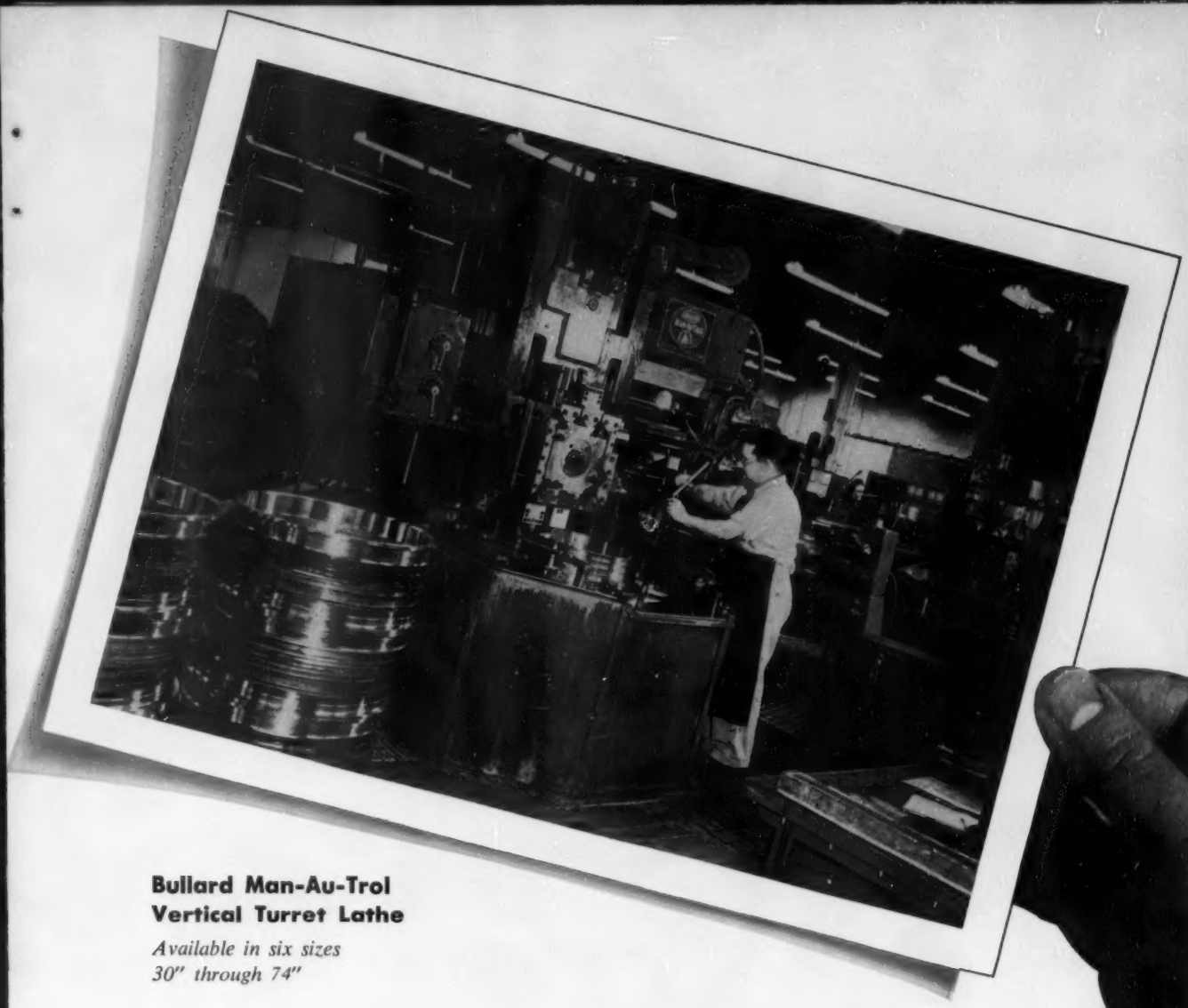
BULLARD

The Invisible Background of Industrial Progress

Travel by air is an integral part of our everyday living — both for business and pleasure. In everyday business, air transport makes it possible for personnel, materials and finished products to arrive at destinations in a mere matter of hours, when, a few years ago, the same mileage required days or even weeks. For pleasure, it enables the vacationist to reach many far-away places in less than a day — a modern "magic carpet."

To maintain and service our vast network of airlines requires tractors, luggage carts, food and fuel supply trucks — manufactured through the use of *Modern Machine Tools* — "The Invisible Background of Industrial Progress."

THE BULLARD COMPANY • BRIDGEPORT 2, CONNECTICUT

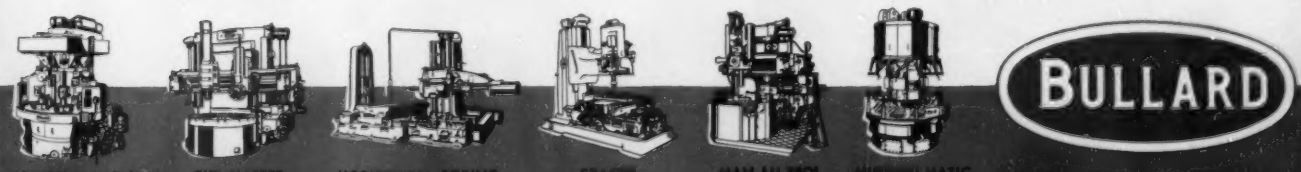


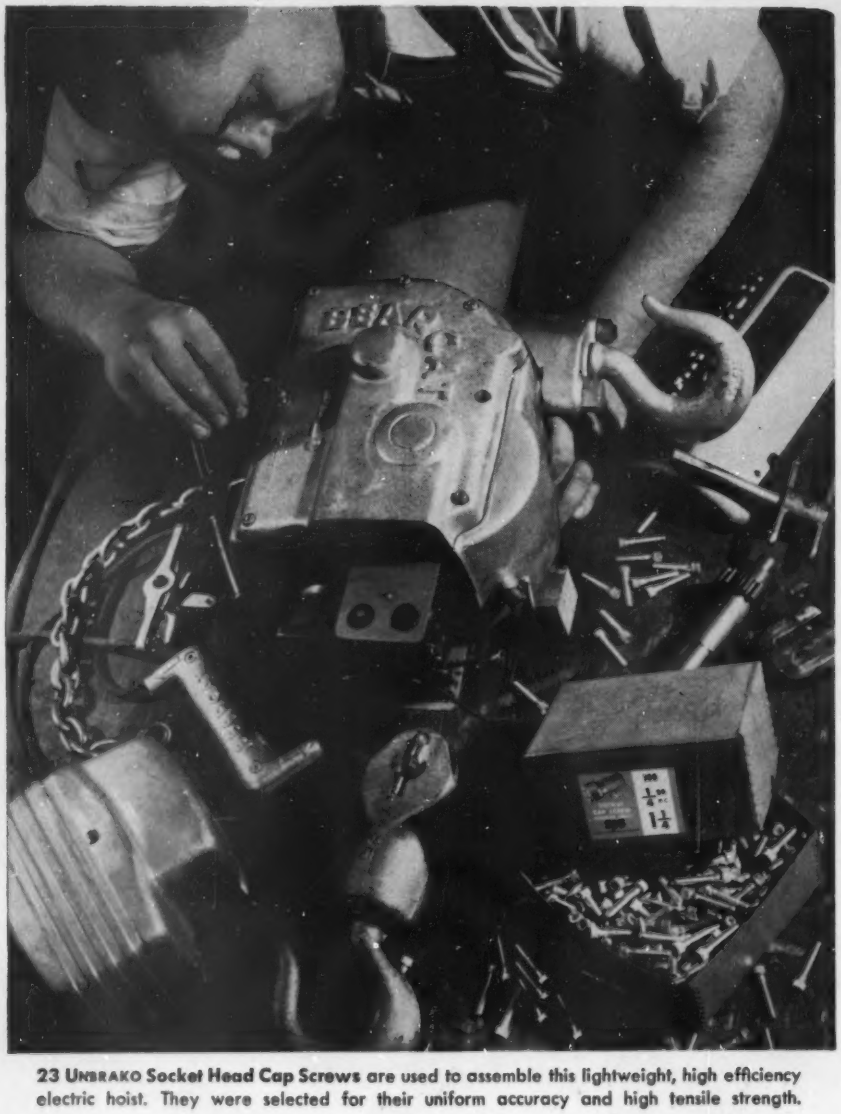
Bullard Man-Au-Trol
Vertical Turret Lathe

Available in six sizes
30" through 74"

It's the cost per cut that counts! The Man-Au-Trol Vertical Turret Lathe, because of its inherent built-in flexibility and versatility, reduces cutting costs to a minimum. The machine may be controlled either manually by the operator or entirely automatically by Man-Au-Trol.

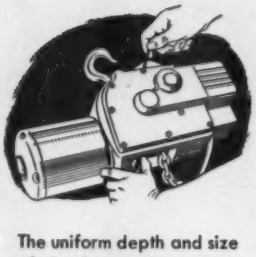
Simple operation, minimum time for operator training, all controls within easy reach, less operator fatigue and low maintenance cost with a minimum of down time are profit plus operating factors offered by the Bullard Man-Au-Trol Vertical Turret Lathe. Ask your Bullard Representative for all the facts or write to The Bullard Company, Bridgeport 2, Connecticut — phone EDison 6-2511.





23 UNBRAKO Socket Head Cap Screws are used to assemble this lightweight, high efficiency electric hoist. They were selected for their uniform accuracy and high tensile strength.

The knurling on the head of UNBRAKO Socket Head Cap Screws permits faster assembly, because of the positive slip-proof grip.



The uniform depth and size of the hex socket assure strength and maximum torque in wrenching—extremely important in the cap screws used to fasten assemblies like this.

UNBRAKOS—made of heat treated alloy steel—have fully formed threads, Class 3 fit; controlled fillet and continuous grain flow for strength. In standard sizes from # 4 to 1".

Save time and money by using UNBRAKO Standards... stocked by your distributor

You'll have less money tied up in inventory, you'll need less space for storage, you'll get personalized service and faster deliveries. And you'll be buying the finest socket screw products that modern machines, complete facilities and quality control can produce. Write for UNBRAKO Standards, a complete listing of socket screw products made by the world's largest producer. STANDARD PRESSED STEEL CO., Jenkintown 1, Pa.

UNBRAKO® SOCKET SCREW DIVISION

SPS JENKINTOWN PENNSYLVANIA

National Tool Co.

Years of successful experience in special tooling and related production problems are yours for the asking. When the job requires special cutting tools call in your National Tool Co. representative. He is backed by more than 49 years experience in the engineering and manufacture of special cutting tools. His assistance is yours, without obligation, whether you're interested in one tool or a complete tooling program.

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Cut Costs and
Increase Efficiency with

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LONG BED MILLING MACHINES

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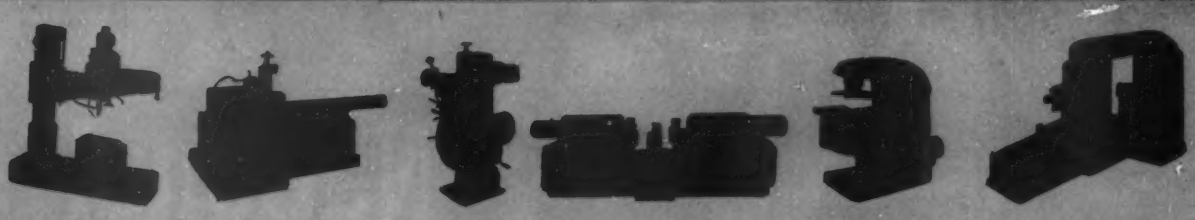
KNEE & PLANER TYPE MILLING MACHINES
COLD SAWING MACHINES • SAW SHARPENING MACHINES • SAW BLADES • TRANSFER MACHINES • SPECIAL MACHINES

Builders of medium and heavy Long Bed Milling Machines with independently controlled milling carriages through electro-hydraulic operation.

Illustration shows machine specially designed for milling rotor slots and for work on heavy frames, bonnets, and large miscellaneous types of castings.

Available in smaller machines from 15 HP rated carriages up to 400 HP milling carriages.

Importing Heller Machines Since 1926



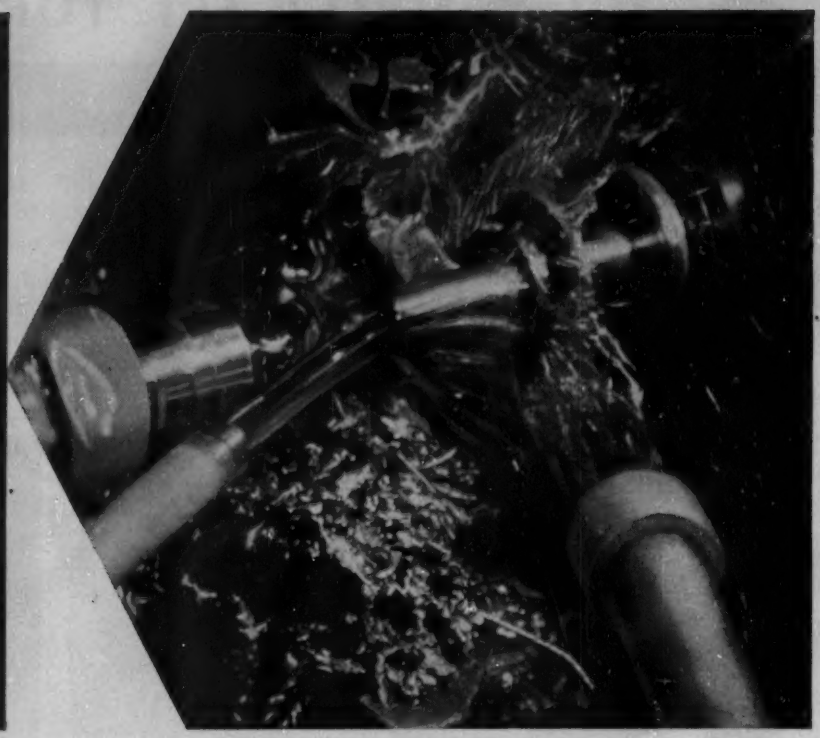
DRILLING MACHINES | COLD SAWING MACHINES | SAW SHARPENING MACHINES | TRANSFER AND SPECIAL MACHINES | KNEE TYPE MILLING MACHINES | PLANER TYPE MILLING MACHINES

NEW

ATLANTIC

Cutting

Oils



Cut the Tough Jobs Down to Size

No need to pamper these Atlantic Cutting Oils. Put them to work on the toughest cutting job in the shop. Then see the difference they can make . . . in long tool life, top production, even in shop morale.

Notice how Atlantic non-soluble cutting oils give you high production on hot, tough jobs — and without foul odors. Note, too, that the work is visible right through the oil. All these oils are compatible when blended.

Operators like Atlantic Cutting Oils because they do not indelibly stain hands and clothing . . . they make a cleaner shop possible.

You can get full information on these oils and a copy of the valuable new Cutting Oil Selector Chart, which shows how to select the right Atlantic Cutting Oil for the job. Just write for your copy to a nearby Atlantic office, listed here, or to The Atlantic Refining Company, 260 South Broad Street, Philadelphia 1, Pa.

ATLANTIC

LUBRICANTS · WAXES
PROCESS PRODUCTS

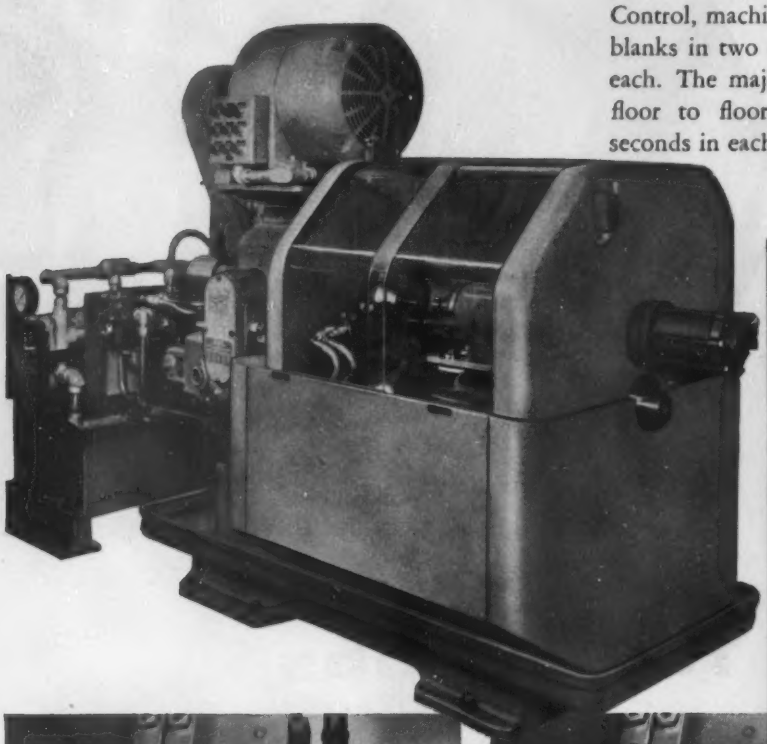
PROVIDENCE, R. I., 430 Hospital Trust Bldg.
READING, PA., First and Penn Avenues
SYRACUSE, N. Y., Salina and Genesee Streets
PITTSBURGH, PA., Chamber of Commerce Bldg.

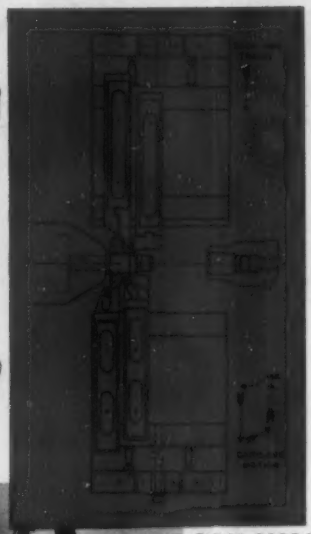
Fay Automatics combine **AUTOMATICITY** and **HIGH VELOCITY TURNING**

with results like this —

STEEL GEARS
18 Seconds Floor to Floor — 635 SFM

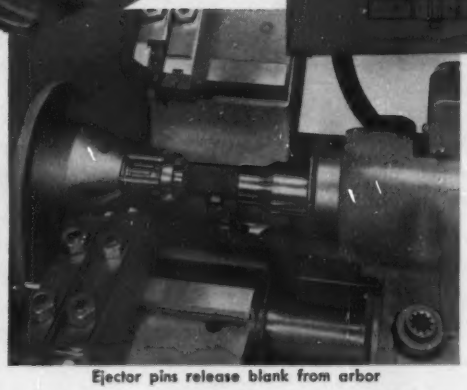
Two 8″ Fays, with Automatic Sequential Control, machine all exterior surfaces of the blanks in two operations; one machine for each. The major diameter is 2-15/16″ and floor to floor time is approximately 18 seconds in each operation.





FIRST OPERATION:
Note intricate movements of the carriage, which turns the hub, back angle and major diameter. The back arm faces and forms.

Tailstock presses blank on arbor



Ejector pins release blank from arbor

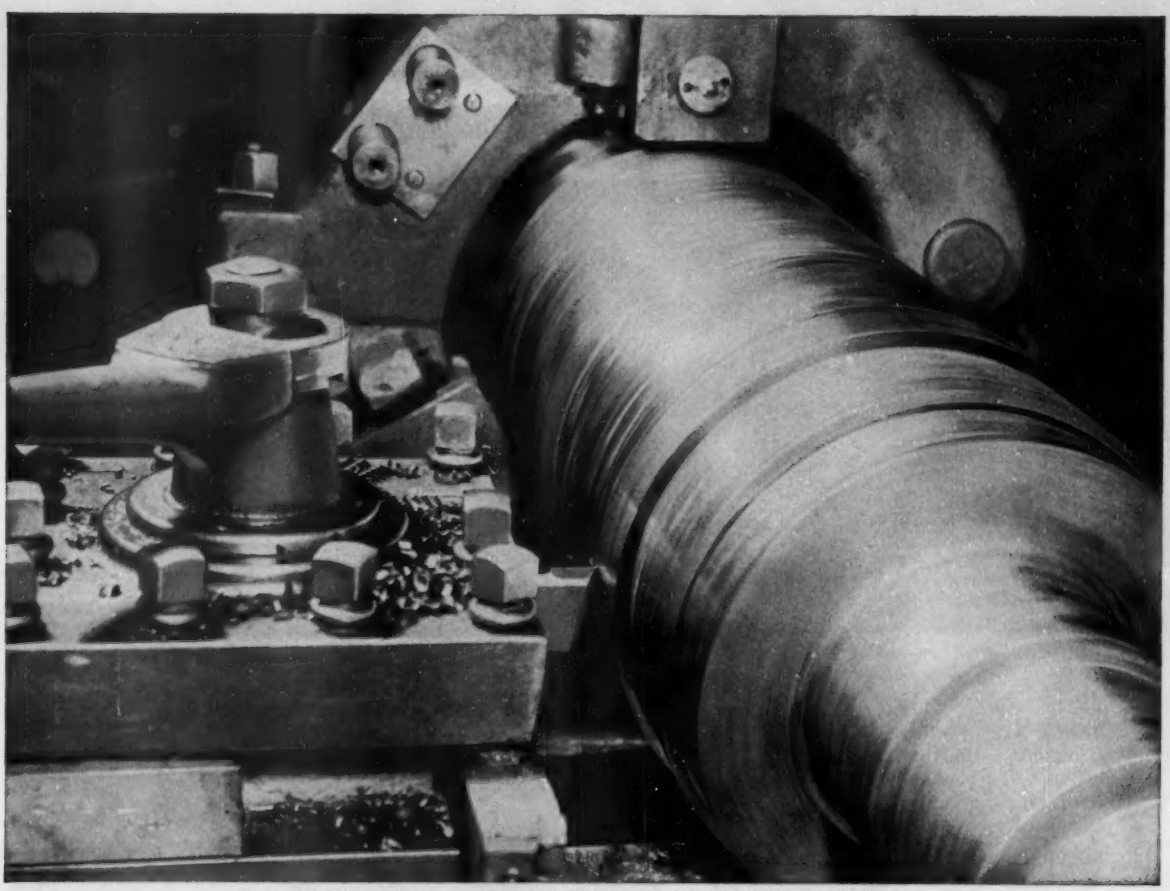
Production management regularly relies upon the engineering services of Jones & Lamson for the latest information on methods, costs, tooling and performance. Why not consult us about YOUR *turning, threading and inspection problems?*

JONES & LAMSON

Machine Tool Craftsmen Since 1835

JONES & LAMSON MACHINE CO., 502 Clinton St., Dept. 710, Springfield, Vt., U.S.A.

J&L MACHINE TOOL DIV.



Turning AISI 1045 modified (hot-rolled) steel, Grade 350 increased tool life, cut downtime, lowered unit costs.

CARBOLOY ANNOUNCES NEW GRADE 350 CARBIDE FOR LIGHT ROUGHING, GENERAL FINISHING OF STEEL

On-the-job tests show that Grade 350 cuts faster, lasts longer than existing carbides; boosts production up to 30%

Carboloy® Grade 350—the second of the new Series 300 steel-cutting carbides—combines superior wear resistance and extreme toughness to an extent never before possible in the light roughing and general finishing range of steel machining. This has been proved on exhaustive on-the-job customer tests and applications (photos, operating data on following pages). Grade 350 is outperforming all existing carbides by up to 30% in this medium-duty range.

Built-In Tip Rigidity

A new, carefully controlled manufacturing process gives Grade 350 a unique grain structure and built-in structural rigidity. This rigidity enables Grade 350 to effectively resist the high temperatures (around 1800° F.) encountered during high-speed machining . . . conditions which cause the cutting edges of other carbides to deform.

Two Steel-Cutting Grades Now Available

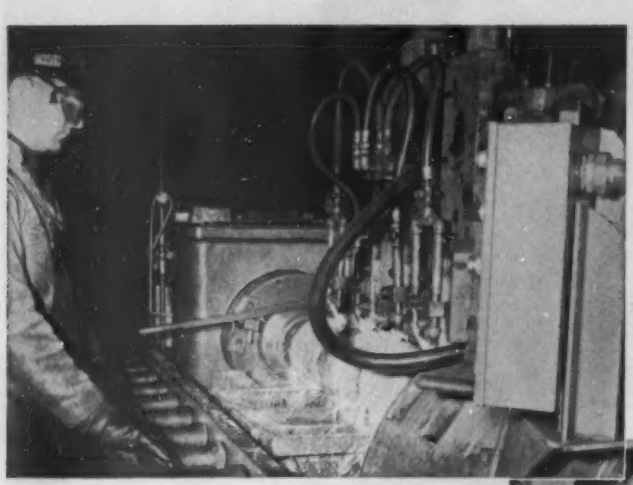
Grade 370 for heavy-duty steel cutting, introduced late in 1953, was the first of the new Carboloy Series 300 carbides. Now Grade 350 extends the machining range of this new series to medium-duty steel cutting. Both grades are available immediately in a wide range of Standard Carboloy Tools and blanks.

Typical in-plant case histories of these two new grades, with photos and operating data, are included on the following pages.

→

CARBOLOY GRADE 350 . . .

For light roughing and general finishing of steel

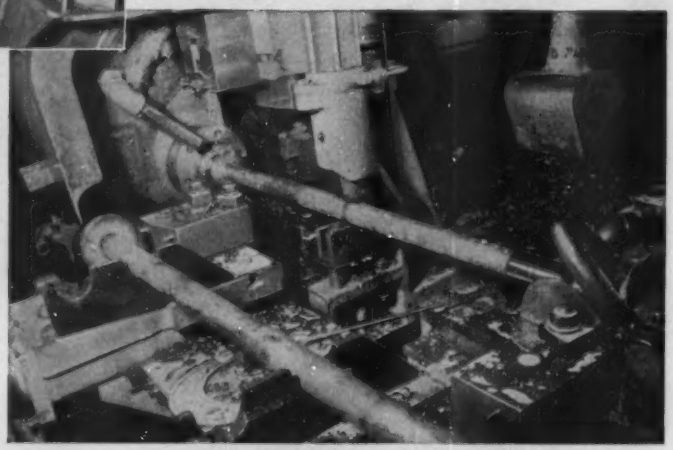


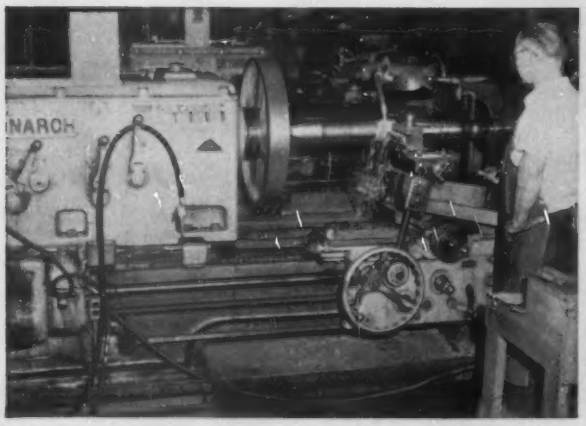
8-INCH STEEL SHELLS. Grade 350 increased production runs on these forged and extruded shells between 15 and 20 pieces per grind. At toughest stage of rough-turning operation, Grade 350 processed 4 times as many shells as other carbides.

SETUP: Material—1045 steel with varying heat analysis. **Speed**—302 SFPM. **Feed**—0.044 inch. **Depth of cut**—3/16 to 1/4 inch. **Coolant**—No.

TRUCK AXLE FORGING. Turning with Grade 350 resulted in 33% more pieces per tool. Chipping and flaking, encountered with previously used tools, were eliminated.

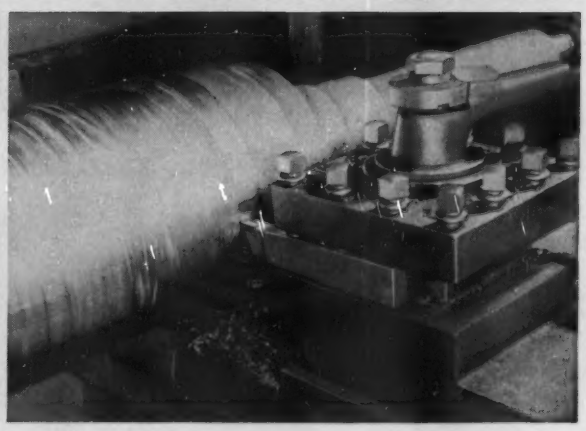
SETUP: Material—AISI 4150 steel forging. **Speed**—200 SFPM on 2-inch diameter; 400 SFPM on 4-inch diameter. **Feed**—0.014 inch. **Depth of cut**—1/16 to 1/8 inch. **Coolant**—Yes.





LANDING GEAR PISTON. Other carbides produced 2 parts per grind at 125 SFPM at Menasco Mfg. Co. Grade 350 increased speed to 185 SFPM. Production per grind went up 6 times; downtime was cut 1/2 hour per shift.

SETUP: Material—4340 heat-treated forged steel. **Speed**—185 SFPM. **Feed**—0.010 inch. **Depth of cut**—0.060 to 0.200 inch. **Coolant**—Yes.



ELECTRIC MOTOR SHAFT. Carboloy Grade 350 increased the number of linear inches cut by 30% over other carbides used for roughing and finishing this large steel motor shaft.

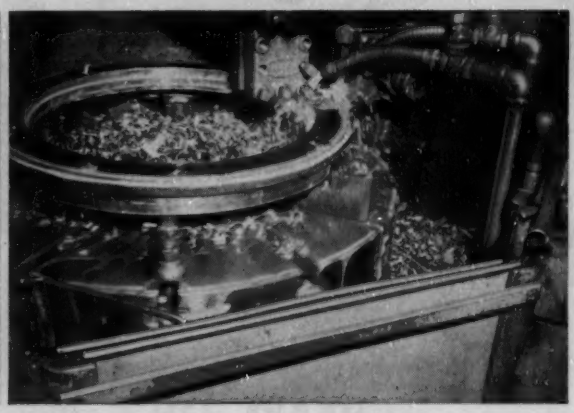
SETUP: Material—AISI 1045 modified (hot-rolled). **Speed**—300 SFPM. **Feed**—0.020 inch. **Depth of cut**—1/16 to 1/8 inch. **Coolant**—Yes.

CARBOLOY GRADE 370 . . .

For heavy-duty steel cutting at higher speeds

JET ENGINE TURBINE WHEEL SHAFT. A single Grade 370 tool now handles roughing and finishing at General Electric's Lynn River Works. Formerly, two tools were needed. Though operating at around 1700° F., Grade 370 increased tool life at least 40%.

SETUP: Material—4340 steel with Brinell hardness from 269 to 321. **Speed**—200 SFPM. **Feed**—0.018 inch. **Depth of cut**—⅜ to ¾ inch.

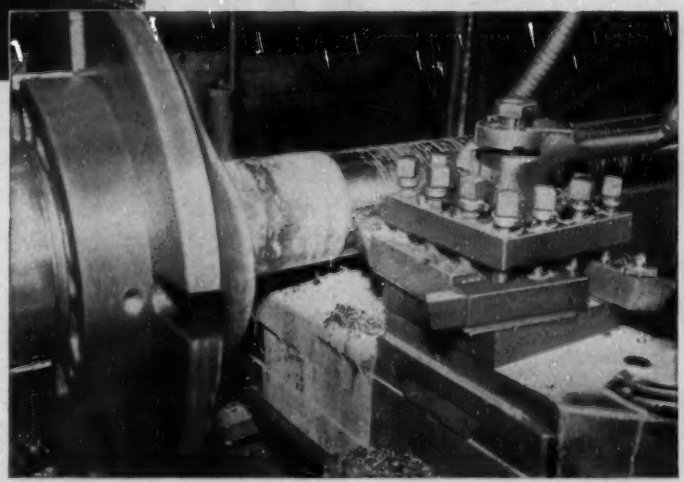


JET ENGINE TURBINE WHEEL RIMS. With Grade 370, G.E. got 300% increase in life of tools used for turning, boring and facing cold-worked Timken steel rims. Downtime was reduced two thirds and tool breakage drastically cut.

SETUP: Material—Cold-worked, forged Timken steel. **Speed**—160 SFPM on O.D.; 110 SFPM on I.D. **Feed**—0.010 inch. **Depth of cut**—½ to ⅝ inch. **Coolant**—Yes.

← **TRANSMISSION CASING** for fork lift truck. Machine downtime was sliced 50% and tool life extended almost 40% when Yale and Towne switched to Grade 370. Despite irregular steel casting, tool life on plunge facing operation increased 5 times with Grade 370.

SETUP: Material—Irregular cast steel with chilled spots and sand occlusions. **Speed**—318 SFPM. **Feed**—0.006 inch. **Depth of cut**—⅜ to ½ inch. **Coolant**—No.



DRIVE ROLLER SHAFT. Use of Carboloy Grade 370 on this heavily scaled forging reduced machining time 25% at Thew Shovel Co., Lorain, Ohio. Tool life was increased almost 50% and cratering encountered with other tools was eliminated.

SETUP: Material—AISI 1035 hot-rolled forging. **Speed**—336 SFPM.—**Feed**—0.025 inch. **Depth of cut**—½ inch.

Grades 350 and 370 now available in a wide range of standard tools and blanks

Many Standard Carboloy Tools are now tipped with Grades 350 and 370. In addition, blanks and inserts of each grade are available in several styles and in many sizes.

Your Authorized Carboloy Distributor now has complete stocks of tools and blanks to fill most of your requirements. Other styles and sizes are available nonstock.

For more information on medium-duty Grade 350 and heavy-duty Grade 370, and for price lists and specifications, send coupon, today.

For light roughing and general finishing of steel

GRADE 350

STOCK ITEMS

Blanks—6 styles, 40 sizes

Tools—5 styles, 20 sizes

Other styles and sizes available nonstock

For heavy-duty steel cutting

GRADE 370

STOCK ITEMS

Blanks—6 styles, 55 sizes

Tools—9 styles, 26 sizes

Other styles and sizes available nonstock

CARBIDES FOR ALL YOUR MACHINING

In today's competitive economy, carbides can cut your unit production costs on machining all materials—ferrous or nonferrous, metallic or nonmetallic.

Standard Carboloy Tools and blanks in other grades suited for your job are available. Contact your local Carboloy Authorized Distributor or salesman for tooling assistance. Send coupon, today, for free, new Brief-A-Log (GT-280) containing complete specifications and new lower prices!

CARBOLOY

DEPARTMENT OF GENERAL ELECTRIC COMPANY

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☐ Send Price List GT-300, containing specifications and prices on new Grades 350 and 370

☐ Send new Brief-A-Log GT-280, containing specifications and prices on Standard Carboloy Tools and blanks in other grades

Name_____ Position_____

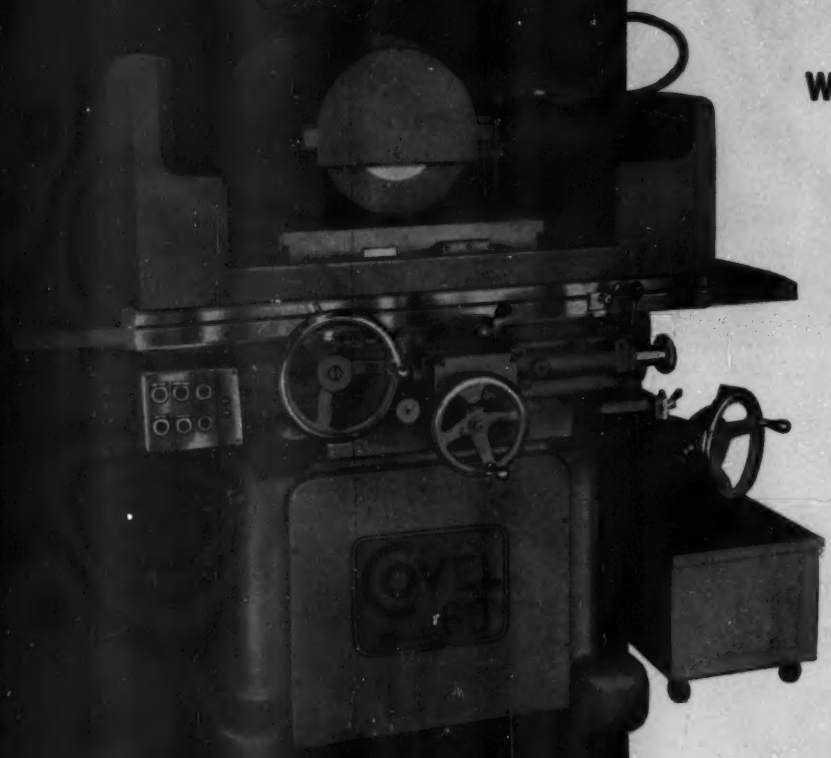
Company_____

Address_____

City_____ Zone_____ State_____

COVEL No. 60 SURFACE GRINDER . . . ENTIRELY NEW

WITH 15" CROSS FEED



Covel presents the No. 60 — latest in its 80-year line of precision machines . . . This ultra-modern surface grinder features a 14" x 24" work surface . . . 15" width of cross feed . . . 27" table travel . . . vertical work capacity of more than 18" . . . automatic, closed circuit hydraulic system . . . powered elevation and a long list of advantages best described in a new bulletin . . . yours for the asking.

Here's a Typical Use:

This new "60" is set up for wet grinding the surface of a trim die for die castings — but one of the wide range of tool room and production jobs for which this latest Covel grinder is suited.

WRITE FOR *New Bulletin* No. AM-144

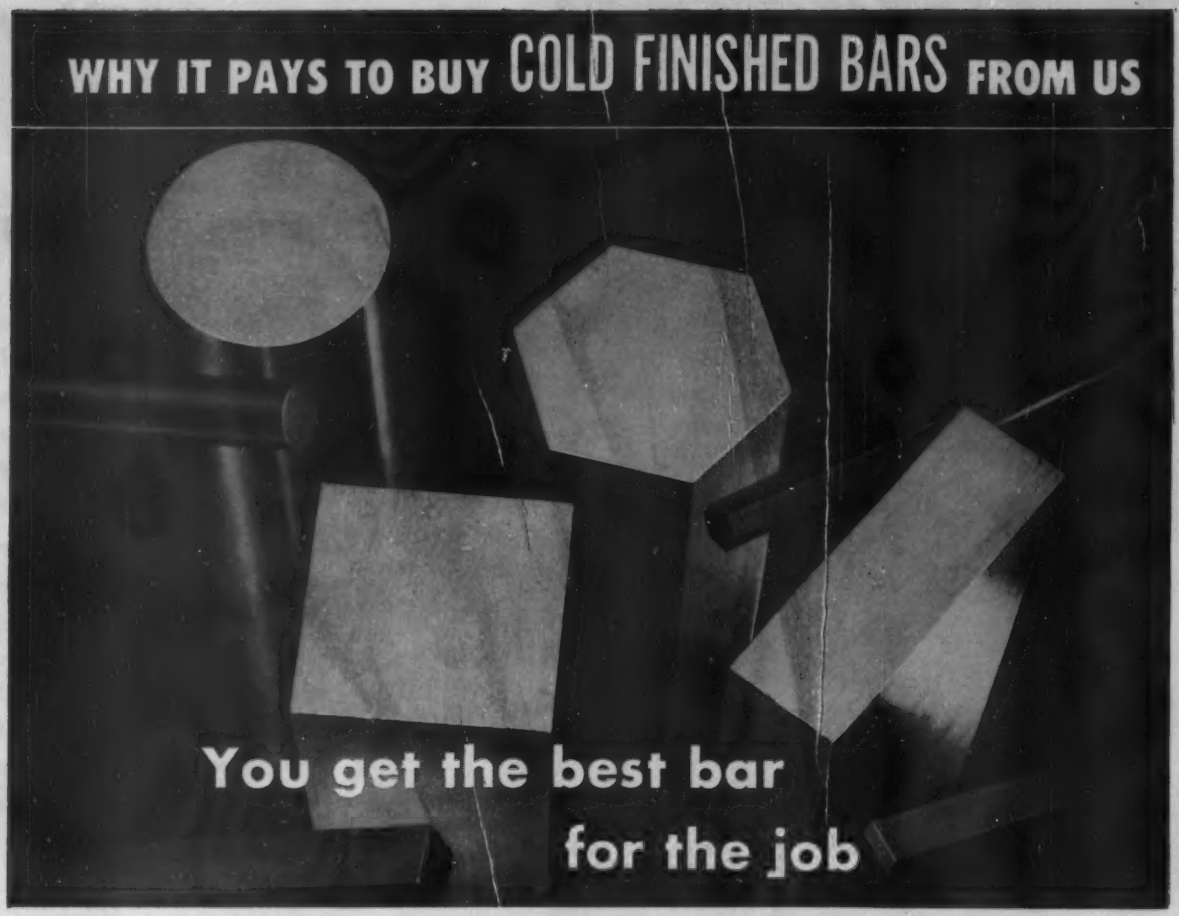
80 YEARS of continuous manufacturing experience makes your COVEL choice a sound one

COVEL PRECISION GRINDERS

BENTON HARBOR, MICHIGAN

DRILL GRINDERS • UNIVERSAL CUTTER & TOOL GRINDERS • HYDRAULIC & HAND FEED SURFACE GRINDERS

WHY IT PAYS TO BUY COLD FINISHED BARS FROM US



• Our experienced technical staff will help you determine what grade of cold finished bar would best help cut costs in *your* shop. Often, you can realize great savings by not overbuying quality . . . the best bar for the job is *not* necessarily the most expensive.

The large, ready-to-deliver stocks in all our warehouses include a wide variety of types in the sizes and shapes most commonly used. These cold finished bars are produced under exacting quality control by the world's foremost steel manufacturer —United States Steel.

When you want the best in cold finished bars, combined with sound technical assistance and prompt delivery, call your nearest U. S. Steel Supply warehouse. We carry: cold finished rounds, squares, hexagons, flats and precision shafting in all grades; cold finished screw stock, Bessemer rounds, "MX" high speed screw stock.

TRIPLE SECURITY

What you want
When you want it
At the right price

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DIVISION

General Offices
208 So. La Salle St., Chicago 4, Ill.

USS

Warehouses and Sales Offices
Coast to Coast

USS STEEL
UNITED STATES STEEL

UNITED STATES STEEL

No. 3 in a Series

Conomatics demonstrate carbide tools

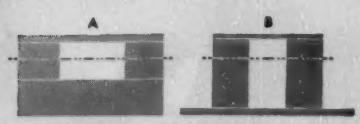
We believe you know that not every "automatic" job can be tooled successfully with 100% carbide. What we think you may not know is that the Conomatic Carbide Development program is making progress with such jobs. This relatively new Cone service is convincing to those who like to be shown that "it can be done".

Granted that experimental runs are not production runs, it has often been proved that under actual production conditions they have developed into production runs. A number of conditions must be met in the successful use of any tooling material. Carbide is no exception. If the comparisons of 100% carbide and HSS runs indicate as much gain as per the job illustrated, the reward is worth the effort.

For full particulars please consult your Cone Representative or inquire direct.

MATERIAL—EVERDURE: (96% copper, 3% silicon, 1% manganese) Hole drilled with 17/32" drill to 1½" depth; thread rolling of ½" pipe thread.

	HSS	CARBIDE
Cycle Time	35 secs.	15 secs.
Work Spindle Speed	420 R.P.M. at 124 S.F.	850 R.P.M. at 250 S.F.
Tool Wear	2000 pcs. per grind	5000 pcs. per grind



The CONOMATIC is the ONLY representative of Frame "A". The short, "weave-proof," upright members, secured between larger and heavier top bed and base, make possible the strongest type of bridged support to the tooling area and its "work and tool axis."

Conomatic } CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.

Two words that mean THE LAST WORD in the design and manufacture of taps:

BALANCED *Action*

All Winter Taps—standard or special—are BALANCED ACTION TAPS. They give you size control and maximum tool life.

CALL YOUR WINTER DISTRIBUTOR

Your local Industrial Supply Distributor carries a complete stock of WINTER Balanced Action Taps.

EXACT FLUTE SPACING

UNIFORM FLUTE CONTOURS

PRECISION CHIP DRIVER CONTOURS

ACCURATE AND CONCENTRIC CHAMFERS

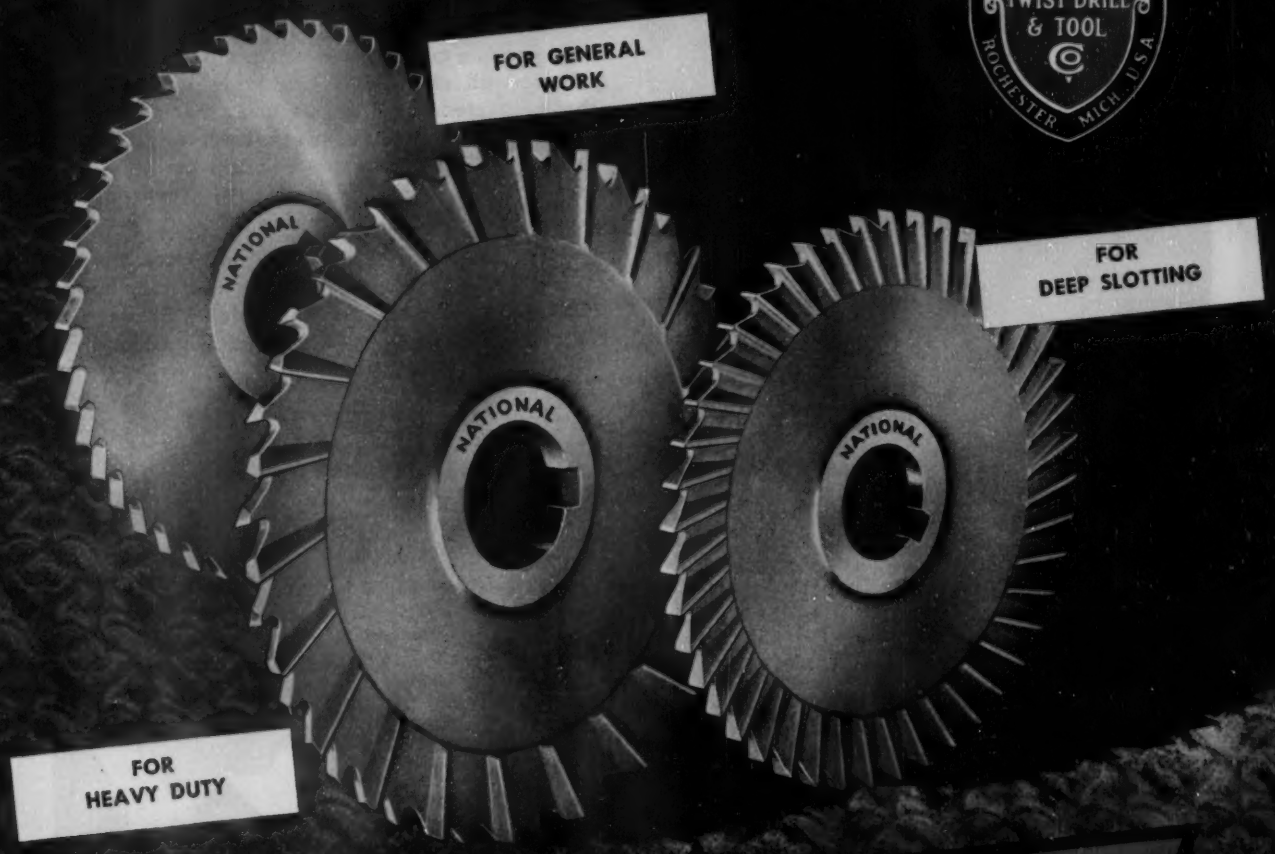
WINTER

WINTER BROTHERS COMPANY

Rochester, Michigan, U.S.A.

Division of National Twist Drill & Tool Co.

National



NATIONAL TWIST DRILL & TOOL CO. ROCHESTER, MICH., U.S.A.

For sawing and slotting . . . use NATIONAL CUTTING EDGES

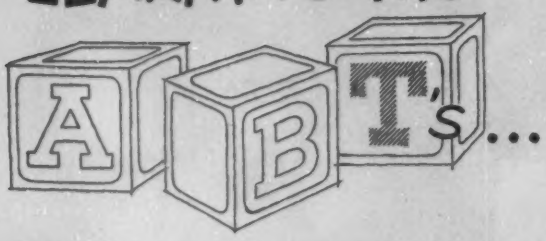
Get the Saw with the bite that fits your job. You'll find it in the National line. All are designed to minimize fine chips and dust. No binding—no scoring.

NATIONAL TWIST DRILL AND TOOL COMPANY

Rochester, Michigan, U. S. A. Distributors in principal cities. Factory Branches: New York • Detroit • Chicago • Dallas • San Francisco • Los Angeles

CALL YOUR INDUSTRIAL SUPPLY DISTRIBUTOR for all your staple industrial needs, including NATIONAL Twist Drills, Reamers, Counterbores, Milling Cutters, End Mills, Hobs and Special Tools.

LEARNING HIS



...

You can't expect a seven-year old, just beginning to cross his T's, to understand the intricacies of a T Lathe. But kids say bright things. This youngster, on a recent plant tour, summed up the outstanding characteristic of the 60" T Lathe, exclaiming: "Gee, that powerful machine sure is gentle."

Yes, the T Lathe is "gentle" — is sensitive to the most delicate cut. T Lathes are designed specifically for thin-wall, short length and large diameter work that characterizes jet engine and other production. These lathes have solved the problem of straight and contour facing, turning and boring parts formerly machined on over-size, over-costly, over-clumsy conventional lathes and boring mills.

Far faster, more sensitive and accessible to the work, they save cost, time and floor space. Write for Bulletin No. 215, The Lodge & Shipley Co., 3055 Colerain Avenue, Cincinnati 25, Ohio.

Unsurpassed Inspection Versatility

JONES & LAMSON OPTICAL COMPARATORS

The Essence of Quality Control

Jones & Lamson Optical Comparators are designed and built like rugged machine tools to withstand vibration and hard use. Yet they have the built-in accuracy to satisfy the most exacting laboratory standards.

- They meet the requirements of toolroom, laboratory and production inspection.
- They precisely measure height, depth, lead or spacing, as well as angles to degrees and minutes. They will measure to .0001".
- They compare intricately contoured parts with a master outline—and measure the amount of error.
- They are convenient to operate, easy to set up and read direct—*without computation.*
- They operate under normal lighting conditions. *No darkroom is needed.*
- They will photograph the enlarged shadow and record its relationship to a master chart.
- Several persons may study the shadow *at the same time.*
- They will inspect and measure surface contours, as well as profiles of objects such as type faces, stamping dies, punches, worn tools, etc.

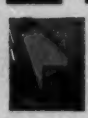
P.S. A complete line of STANDARD CHARTS and FIXTURES is maintained by us.

JONES & LAMSON

Machine Tool Craftsmen Since 1835

JONES & LAMSON MACHINE COMPANY
502 Clinton St., Springfield, Vt., U.S.A.

J&L COMPARATOR DIV. Dept. 710



Jones & Lamson Machine Company
502 Clinton Street, Dept. 710
Springfield, Vermont, U. S. A.
Please send Comparator Catalog No. 402.

NAME_____ TITLE_____

COMPANY_____

STREET_____

CITY_____ STATE_____

Acme-Gridley 6 Spindle Bar Automatic—

with ACME-GRIDLEY Bar Automatics

Whether you "automate" or pick 'em up with your fingers, you're going to have a certain amount of handling in making any product. But, the less *re*handling—the faster the job is done and the lower the cost per piece.

That is why more and more manufacturers are getting more operations on their primary machining equipment. It's also why, every day, more intricate parts like these—and larger ones, too—are being *completed in one setup* on multiple spindle Acme-Gridley bar machines.

Ingenious tooling of these versatile machines with standard National Acme toolholders and attachments often eliminates second operation work entirely—saves not only handling, but also extra machines, floor space and valuable man-hours. And in addition, the parts are more accurate because you don't have to re-chuck.

Check your machining methods today—then ask your engineers and ours to talk it over.

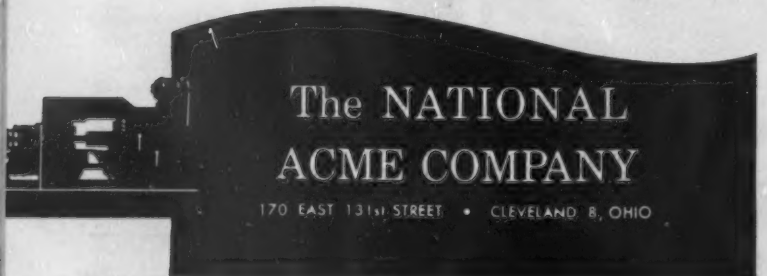
Remember—the biggest help to your competition is your continued use of obsolete equipment.

ON JOBS LIKE THESE

DRILLED STUD 3/8" diameter, 2 1/4" long.
MATERIAL: B-1113 CD Steel.
OPERATIONS: 12 including rolled thread and spindle stopper for cross drilling to blind hole.
MACHINE TIME: 9 seconds (400 completed pieces per hour.)
(Formerly done in two setups)

WORM 3/8" diameter, 1 3/4" long.
MATERIAL: B-1113 CD Steel.
OPERATIONS: 9 including machining the worm and broaching end of piece.
MACHINE TIME: 8 seconds (450 per hour.)
(Formerly done in three setups)

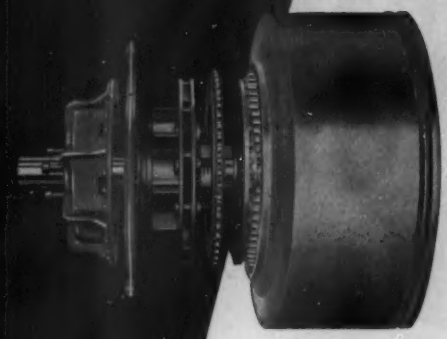
Ask for Catalog M-450



The NATIONAL ACME COMPANY

170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley Bar and Chucking Automatics: 1-4-6 and 8 Spindle Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • Limit, Motor Starter and Control Station Switches • Solenoids • Contract Manufacturing.



Exploded View of Air Operated Disc Clutch

. . . another Columbia exclusive. It eliminates unnecessary gear wear

. . . gives never-failing overload protection

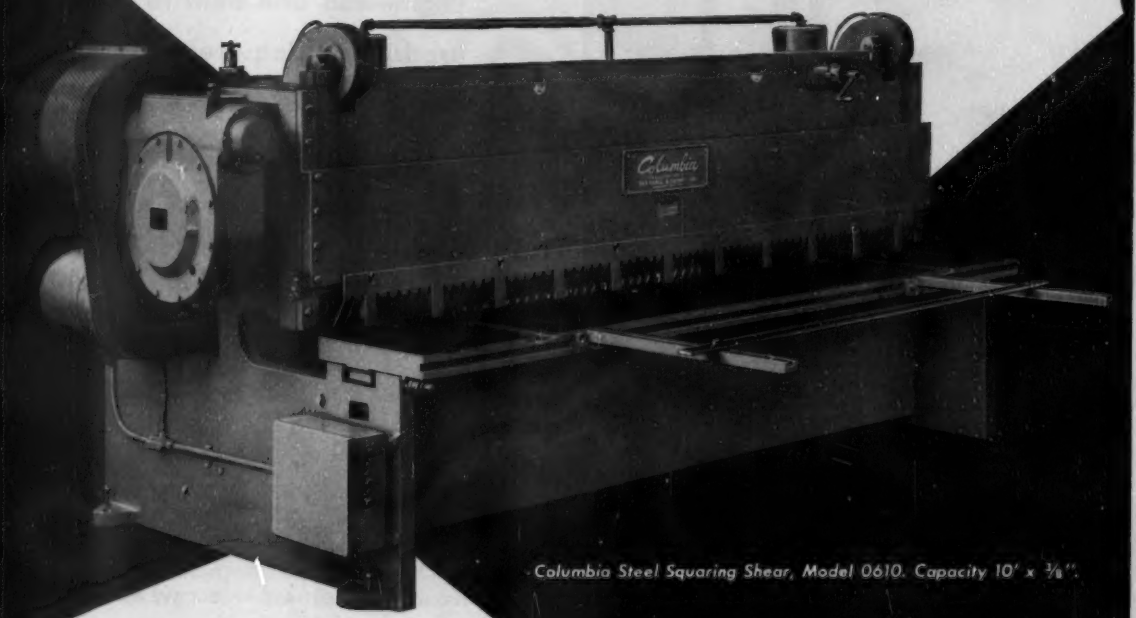
. . . cushions shock!

Columbia
STEEL SQUARING SHEARS
up to 75% less gear wear with the exclusive air clutch!

A cost-reducing, safety Air Clutch is one of the many exclusive, built-in Columbia "New Series" Shear features.

This air-operated clutch reduces gear wear as much as 75% since all gear movement is eliminated except in the actual cutting cycle. Inherent clutch slippage at the overload point protects machine and drive. Air-application of power is soft; shocks are not transmitted.

Other Columbia features you should know about include the exclusive Quick-Set Blade Clearance, Hydraulic Hold-downs, Jog Control for Ram Back Brace Adjustment, Air Counterbalances, Remote Foot Switch, and others. Together with basic ruggedness, rigidity and long-lasting accuracy these features mean that Columbia Shears offer more machine for the money!

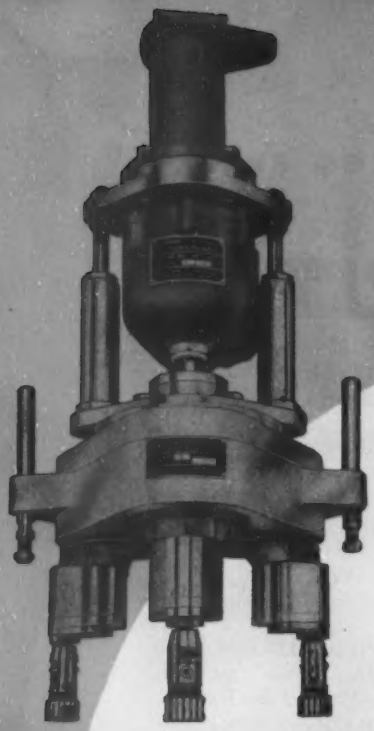


Columbia Steel Squaring Shear, Model 0610. Capacity 10' x 3/8".

Other exclusive Columbia features are explained in detail in FREE Bulletin No. PS-2. Write for it and the name of your Columbia dealer, *today!*

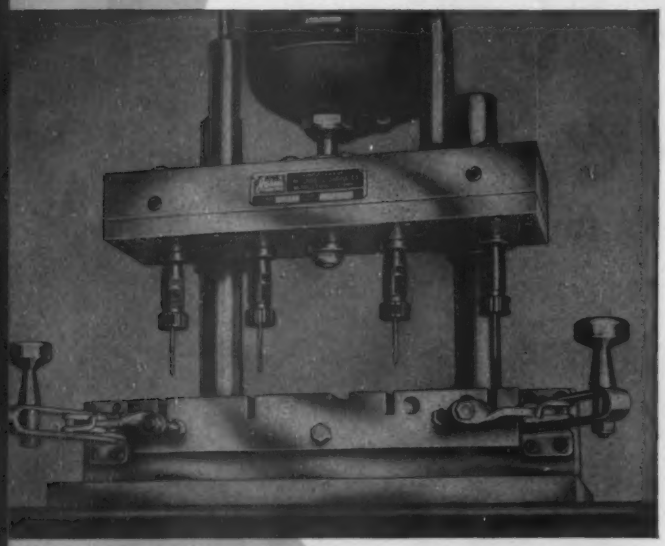
COLUMBIA DIVISION, THE LODGE & SHIPLEY CO.

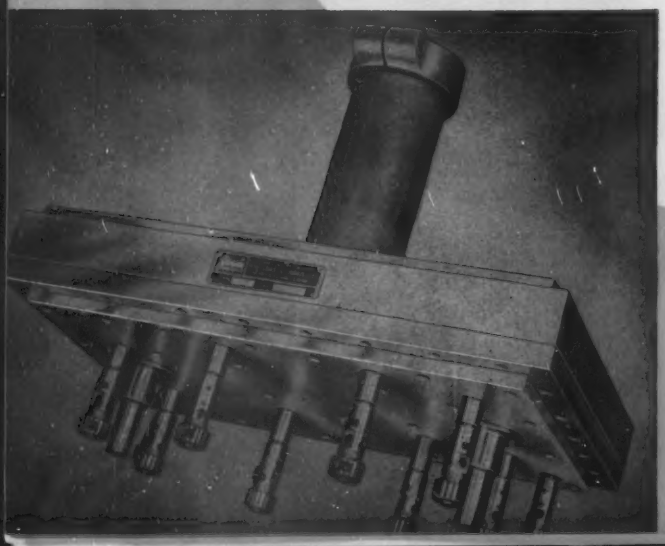
new series Columbia STEEL SQUARING SHEARS and POWER PRESS BRAKES



Jarvis MULTI-TAPPERS

AN INDUSTRIAL MACHINE FOR INDUSTRIAL USERS





For Multiple Tapping and Drilling

Engineered and built to your specific production requirements from our basic standard components, Jarvis Multi-Tappers can be furnished for any type of drill press available.

We invite your inquiries—let us assist in analyzing your tapping and drilling needs!

Send for our catalog featuring Jarvis Multi-tappers

WHEN POWERED WITH A JARVIS TORQOMATIC DRIVE THE JARVIS MULTI-TAPPER PROVIDES THE MOST EFFICIENT AND PRODUCTIVE MACHINE IN THE FIELD.

THE CHARLES L. JARVIS COMPANY

MIDDLETOWN IN CONNECTICUT

Jarvis TAPS

AN INDUSTRIAL TAP FOR INDUSTRIAL USERS

have "Custom Made" Cutting Edges at NO EXTRA CHARGE

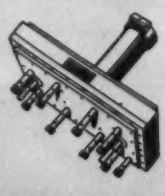
"Custom Made" means just that! Accurate indexing and precision machine grinding of flute and spiral points on Jarvis Taps produce a tool in which ALL the cutting edges do their share of the work. Our highly accurate fluting process makes it possible for us to control for your PARTICULAR NEEDS the amount of hook ground in the flutes. Specify Jarvis, and you'll always have "Custom Made" Taps designed to do a specific job superbly well.

Send for complete New 56 page Tap Catalog and Manual.

Jarvis Manufacturers of . . TAPS

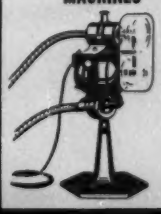
TORQOMATICS

MULTI-TAPPING AND DRILLING



CARBIDE TOOLS

FLEXIBLE SHAFT MACHINES



ROTARY FILES & MOUNTED POINTS

THE CHARLES L. JARVIS COMPANY, MIDDLETOWN IN CONNECTICUT

● Much more than mere salesmen, Standard's lubrication engineers are "Johnny-on-the-spot" when it comes to checking performance, offering advice on new products and otherwise being helpful. Here is J. E. Meyer, Jr. at work in the Trane Company plant. *You* can have advice and service like this. Call your nearby Standard Oil office or write: Standard Oil Company, 910 S. Michigan, Chicago 80, Ill.

the thread of this story depends on..

SUPERLA
REG. U. S. PAT. OFF.
Soluble Oil

● The coils manufactured by the world-famous Trane Company in La Crosse, Wisconsin are the heart of the heating and cooling equipment manufactured by this company. Threaded cast iron headers are used in many of these coils. The job requires cleanly threaded, cleanly finished holes that must be absolutely rust-free to assure maximum trouble-free operation.

Up to 1936, various soluble oils had been tried but none was successful in eliminating work spoilage due to rusting. On the advice of a Standard Oil lubrication specialist a switch to SUPERLA Soluble Oil was made with marked success.

Rejections due to rusting threads have been completely eliminated. At the same time, the quality of the threads has been excellent. In addition working conditions have also been greatly improved—with SUPERLA on the job, there's been no odor development, no gumming up of machines.

SUPERLA Soluble Oil can help you find a happy solution to your lubrication problem. SUPERLA forms stable emulsions . . . helps provide good finish and tool life and has superior rust prevention properties. Call your Standard lubrication specialist today and find out how he can help you.

STANDARD

STANDARD OIL COMPANY
(Indiana)

Here's another reason it pays to get a proposal from Fosdick

"Lathe Bed Production Time Slashed 6 hrs."

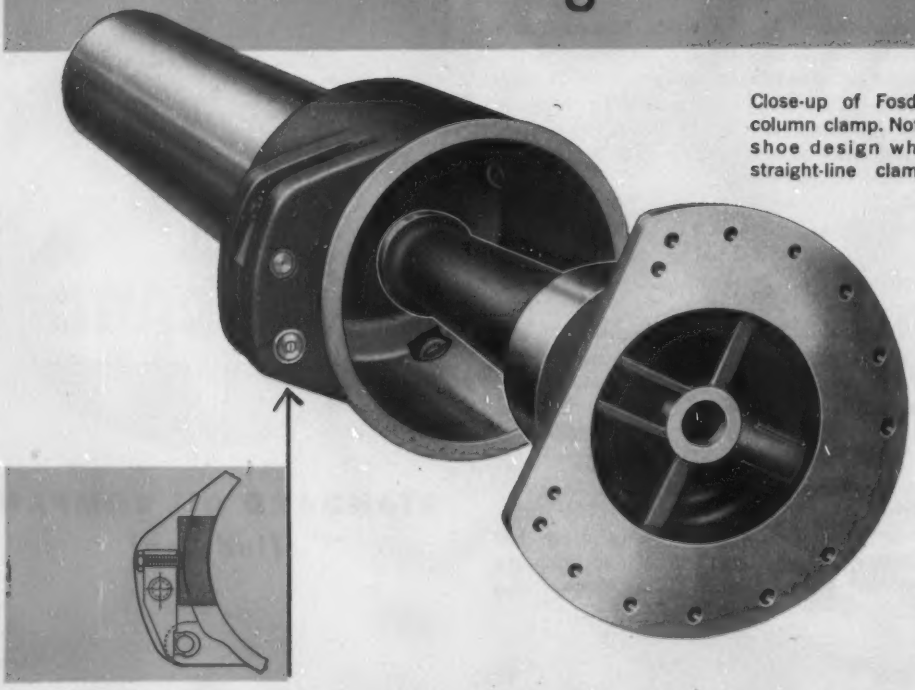
"Since installing our new FOSDICK"...

says Sidney Machine Tool Co.

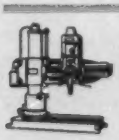
"Our new Fosdick Radial is easy to handle, requires less time for job set-ups. And its operating advantages are numerous. Formerly, we put 28 hrs. into drilling our 28' lathe bed. But with our new Fosdick Radial Drill, we've cut drilling time by 6 hours . . . saved valuable production time! We've found that it pays to get a proposal from Fosdick."

Fosdick Hydraulic Radials are available with 3' to 8' arms, 11" to 19" columns. For full information, ask for Bulletin ATA.

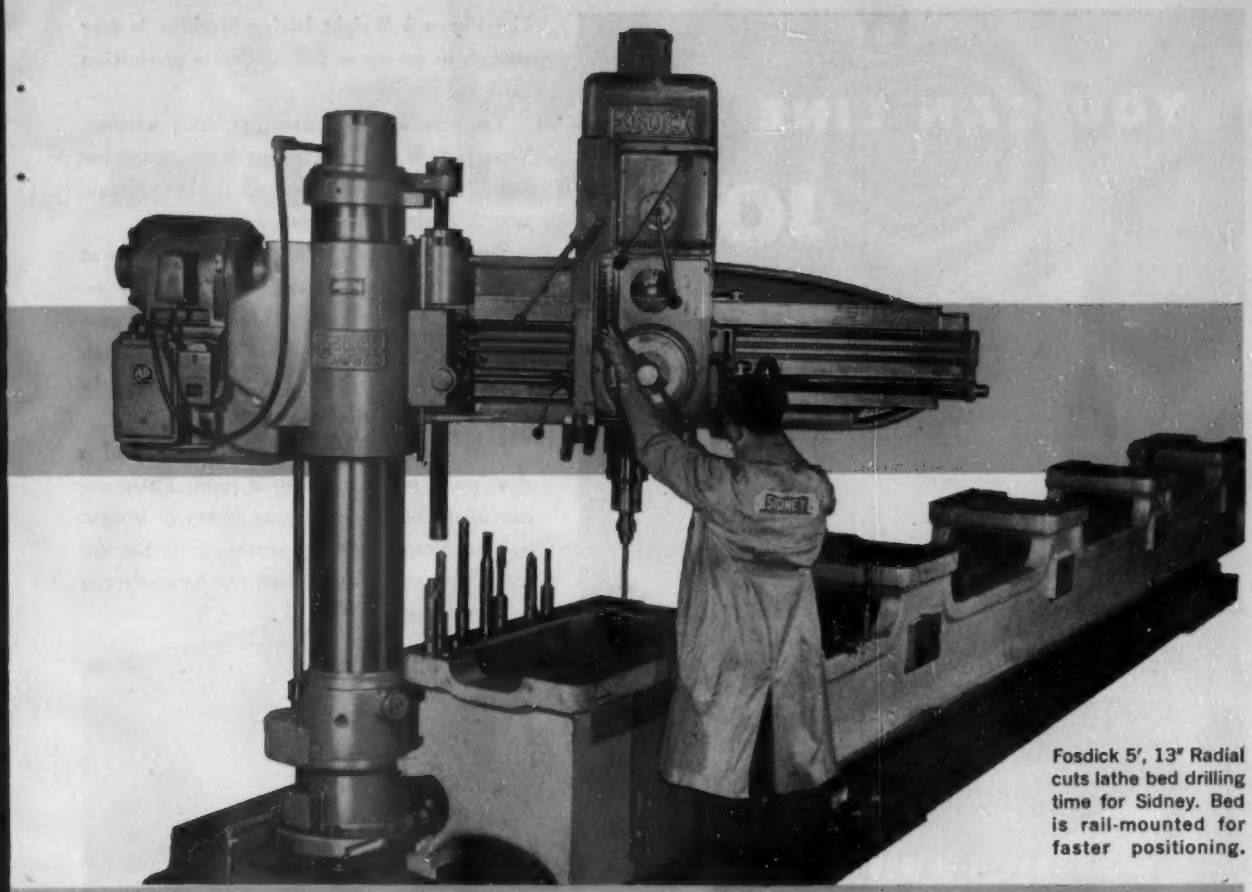
Fosdick Radials give Faster Drilling...



Close-up of Fosdick hydraulic column clamp. Note the sliding-shoe design which gives it straight-line clamping action.



Radial Drills



Fosdick 5′, 13″ Radial cuts lathe bed drilling time for Sidney. Bed is rail-mounted for faster positioning.

More Rigidity . . . Easier Handling.

Fosdick Radials give you many features that insure fast, rigid, precision drilling. To name a few:

Hydraulic Column Clamp. New sliding-shoe design gives rigid straight-line clamping action. Prevents side movement of column for sustained accuracy and speed of drilling.

Locking Control. With this feature, set-up time is reduced to a minimum. When feed mechanism is engaged, an automatic interlock clamps the head and the column. When feed is disengaged, clamping is maintained. This permits the operator to change tools without disturbing the position of the head. Clamping is disengaged by independent levers.

Tool Ejector. For speedy tool removal all the operator has to do is to move the spindle to its extreme upper position. This automatically disengages the tool. No drifts or hammers necessary.

Automatic Positioning Table. Now, available for use with radial drills! Without jigs, the Fosdick Automatic Positioner makes possible exact reproduction of precision drilled, bored, tapped and reamed parts . . . within tenths! For details write for Bulletin AT-A.

Need Drilling Equipment? Get a Proposal from Fosdick!

Jig Borers

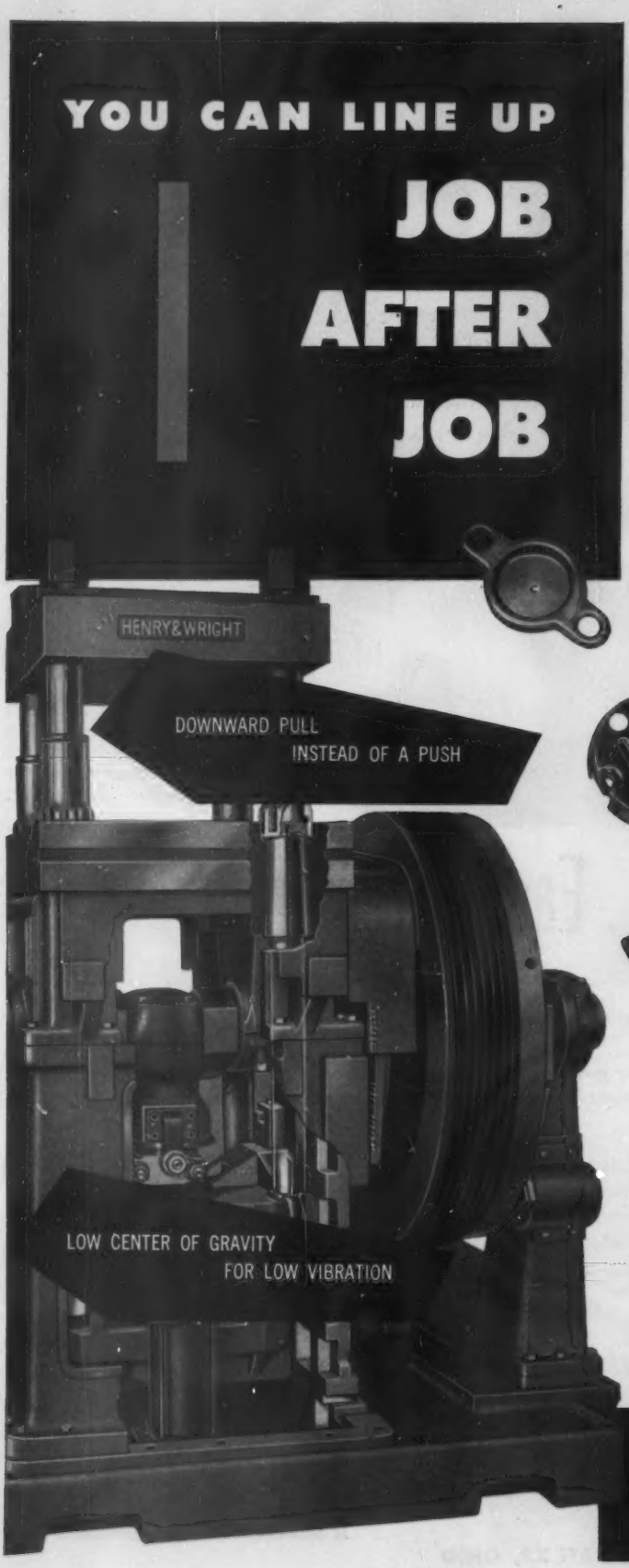
Sensitive and Upright Drills

Sensitive Radial Drills

Automatic Positioning Machines

FOSDICK

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO



The Henry & Wright Dieing Machine is easy enough to set up so that moderate production runs are profitable.

You can schedule one job after another. Your H & W will get the work out, get it out right, and have it done when the schedule says it ought to be done.

Simple jobs that you want to complete at high speed. Close tolerance work. Tricky reverse bends. Full assemblies at one pass through the press. They all will go through your Henry & Wright, and with surprisingly short interruptions for setting up.

Four corner control of side thrust, and a downward pull instead of a push: These are two of the reasons why your Henry & Wright will withstand more off-centering of the die loads. Jobs like those shown can be easily run in sequence on an H & W.

Henry & Wrights are making production runs that designers never had dreamed could be stamped at a profit. Our representative would like to show you some of the pieces.

Please write to Henry & Wright, 481 Windsor Street, Hartford, Connecticut.

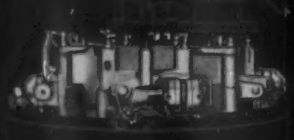
H&W®

HENRY & WRIGHT

DIVISION OF EMHART MFG. CO.

HARTFORD, CONNECTICUT

Swartz
SPECIAL FIXTURES
for
AUTOMATIC TRANSFER
and
INDEX MACHINES



Swartz fixtures were specified for the 4-station Rotary Index Machine shown in the above illustration. The result—dependable, on-the-job fixture performance!

Here is a typical Swartz fixture installation, on a multi-station Transfer Machine. Another example of how Swartz efficiently serves the builders of modern automatic machine tools.

...from PART PRINT to FINISHED FIXTURE!

To both buyer and builder of automatic machine tools, Swartz offers a specialized fixture-building service . . . complete in every detail, from part print to finished product. Swartz fixtures represent the accumulated experience and skill of more than 30 years in this highly specialized field, and the advantages of Swartz service have become increasingly important with the rapid growth of automation.

If you use or build automatic machines, you can profit from Swartz service. Assure yourself of continuous production, with a minimum of costly down-time! *You can,* with dependable Swartz fixtures! They are guaranteed. Call in a Swartz engineer, to discuss your fixture requirements. You'll be glad you did.

Swartz service is presented in a new brochure, "Advancing Automation", and a copy will be mailed on request.

SWARTZ TOOL PRODUCTS
Division of Jefferson Corporation
13334 FOLEY AVENUE • DETROIT 27, MICHIGAN

Designers and Builders of: Special Fixtures for Automatic Machine Tools, Pump Jigs, Standard Fixtures, Fixture Locks

More than 30 Years of Specialized Service to the Machine Tool Industry!

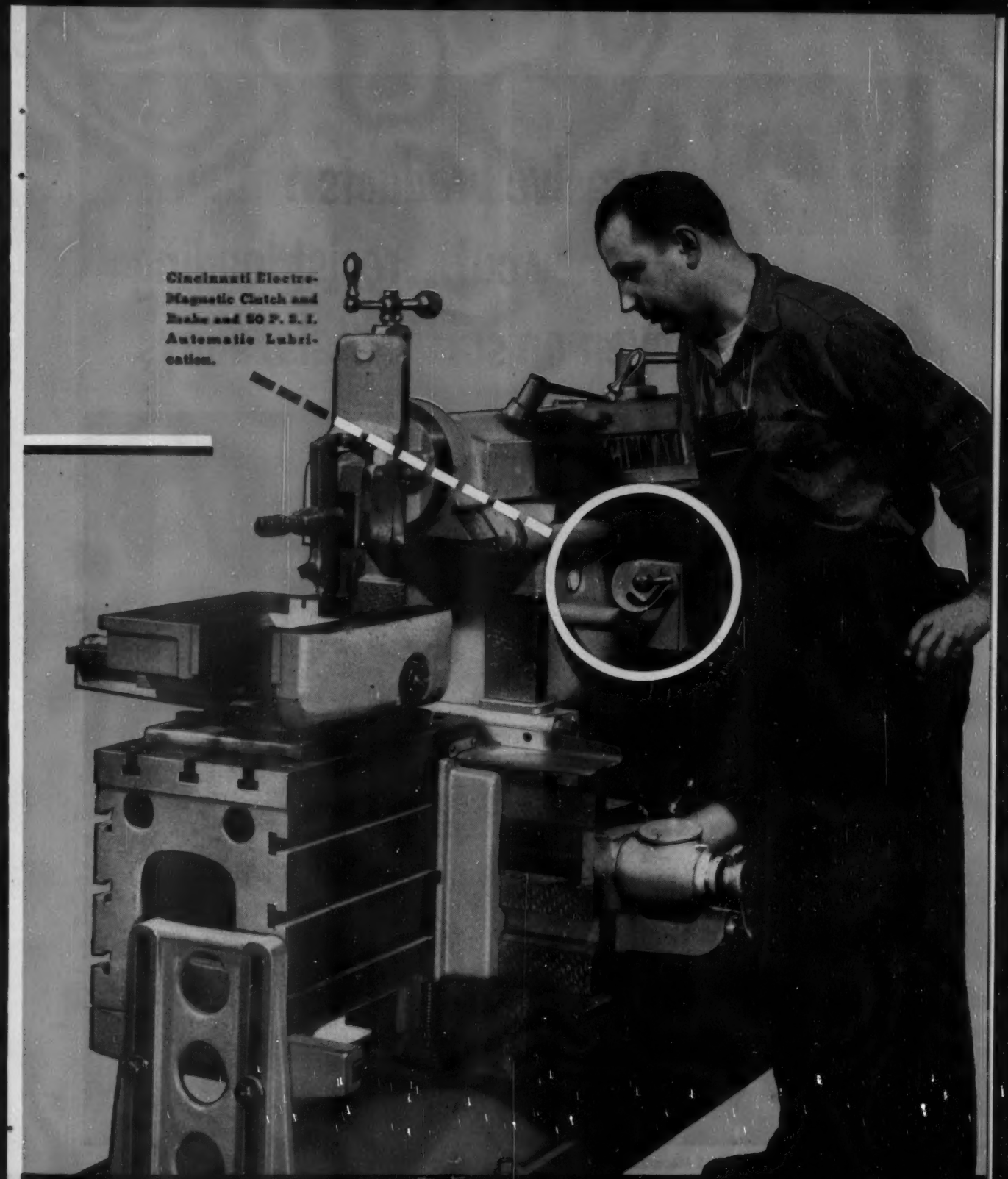
toolmakers prefer this CINCINNATI shaper

17 cubic foot Revco, one of many Food Freezer models built by Revco, Inc., Deerfield, Michigan.

Revco, Inc., producers of Food Freezers, state their toolmakers prefer using this 20" H. D. Cincinnati Shaper. They like the convenience of all controls located at the operator's position and the amazing speed of the electro-magnetic clutch and brake. They like the assurance provided by the 50 P.S.I. automatic lubrication. They like the very high accuracy obtained in shaping jigs and fixtures, drawing, forming and blanking dies.

Write for the new illustrated catalog N-6 on Cincinnati Shapers.

Photo courtesy Revco, Inc., Deerfield, Michigan



THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

CINCINNATI

MX® abrasive products finish as they cut...resist loading even on soft metals, alloys

● Deburring and finishing with MX Mounted Wheel

continually putting **MORE SENSE** in your **ABRASIVE DOLLAR**

● Smoothing seam of welded aluminum casting with MX Disc

● Portable cutting-off with MX Depressed Center Wheel

Fast, clean-cutting MX abrasive products by CARBORUNDUM *finish* as they cut...whether you are removing stock, surfacing, grinding welds, cutting-off or slotting. The resilient composition of MX products produces a soft, cushion-like cutting action—without chatter—that promotes smooth, uniform finishes. They resist loading... even on the soft metals like copper, magnesium, aluminum, or aluminum alloys.

FOR CUTTING-OFF AND SLOTTING operations, MX Production Cut-off Wheels combine rapid cutting with adequate safety... successfully withstand side pressures and heat shock. MX Depressed Center Wheels are also recommended for light cut-off and slotting with portable equipment—as are MX General Purpose Cut-off Wheels.

FOR ROUGH GRINDING, reducing and blending welds, use MX Discs, Depressed Center Wheels or Straight Wheels—depending on the nature of the job.

FOR FINISHING, polishing, deburring, etc., choose the MX abrasive product that best fits the operation; Straight Wheels, Mounted Wheels, Sticks for hand finishing, Depressed Center Wheels, Discs.

FIND OUT TODAY how these versatile MX abrasive products can help lower your costs, speed your production. Call your CARBORUNDUM Distributor or Salesman, listed in the yellow pages under "Abrasives" or "Grinding Wheels." He offers expert counsel, prompt delivery from complete stocks.

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NEW!

MORE VALUABLE INFORMATION ON TOOLING

Here is some new proof of the productive versatility of Sundstrand Automatic Lathes. The information presented in this new book is taken direct from the field-checked and re-checked for accuracy and presented to you so that you may compare the performance of your present turning equipment with the outstanding performance obtained with Sundstrand Automatic Lathes in other plants.

Included in the book are on-the-job action photos and tooling diagrams describing actual applications from modern manufacturing plants.

32 PAGES OF JOB FACTS, TOOLING TIPS AND TECHNICAL DATA

Here are a few of the jobs described in this new book —

- Practical tips on tool setting.
- Turning cylinder liners.
- Turning worm gears and hubs.
- Turning bearing races.
- Turning spherical surfaces.

ALSO . . .

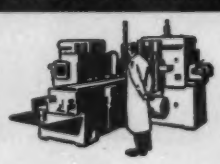
- How to select the proper lathe.
- How to set up the Sundstrand Automatic Lathe.

SUNDSTRAND

"Engineered Production" Service

*REG. U.S. PAT. OFF.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS



SOME OF THE VALUABLE INFORMATION YOU'LL FIND IN THIS BOOK

1 *Practical Tips on Tool Setting*

Two pages of information on setting tools five different ways includes setting tools from master samples, setting tools without master samples, setting tools from tool block gages, setting tools to template and setting tools in magazine.

2 *Multiple Tool Turning In Small Lots*

Nine different job examples are shown on small lot turning of cylinder liners, various shafts, bearings, gear blanks etc. Lot sizes range from 20 to 3000 pieces.

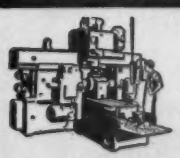
3 *Special Turning*

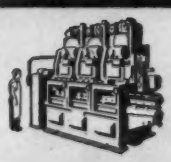
Six widely different solutions to special lathe production problems are shown along with part illustrations and tooling diagrams. Also included are seven long-run turning jobs.

Everyone interested in increasing production will find valuable suggestions in this book

You'll find many lathe jobs similar to yours in this book. You'll also find valuable production data to compare with your present equipment. Write for your copy now. Ask for book 145.

TRIPLEX RIGIDMILS | SPECIAL MACHINES





SUNDSTRAND
Machine Tool Co.
2533 Eleventh St. • Rockford, Ill., U.S.A.

Ingersoll 19-station process milling, boring, drilling, reaming, and chamfering machine for producing 90 V-8 cylinder blocks per hour.

automation at its best uses VICKERS® hydraulics

One operator controls this entire machine in which a total of 20 milling, 18 boring, 16 chamfering and 4 drilling spindles are at work simultaneously. A hydraulic transfer mechanism moves the V-8 engine blocks automatically from station to station . . . turning them as needed . . . clamping and unclamping. Feeding of the tools is also done hydraulically. The entire operation is controlled by electro-hydraulic circuits from the loading station.

Vickers Hydraulics was used throughout by The Ingersoll Milling Machine Company. Among the advantages gained by using Vickers Hydraulics are: (1) simplification of design, (2) flexibility of control, (3) instantaneous response, (4) ease of providing interlocks and overload protection, (5) low maintenance with minimum down time.

The Vickers Application Engineer near you will gladly supply any additional information you may desire regarding the many benefits to be gained by using Vickers Hydraulics.

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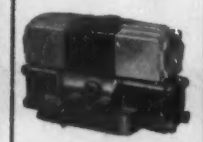
Representative Standard VICKERS® Units Used on Ingersoll Transfer Machines

Single Stage Balanced Vane Type Pump

Double and Two-Pressure Balanced Vane Pumps

Power Unit is Self-Contained Power Source



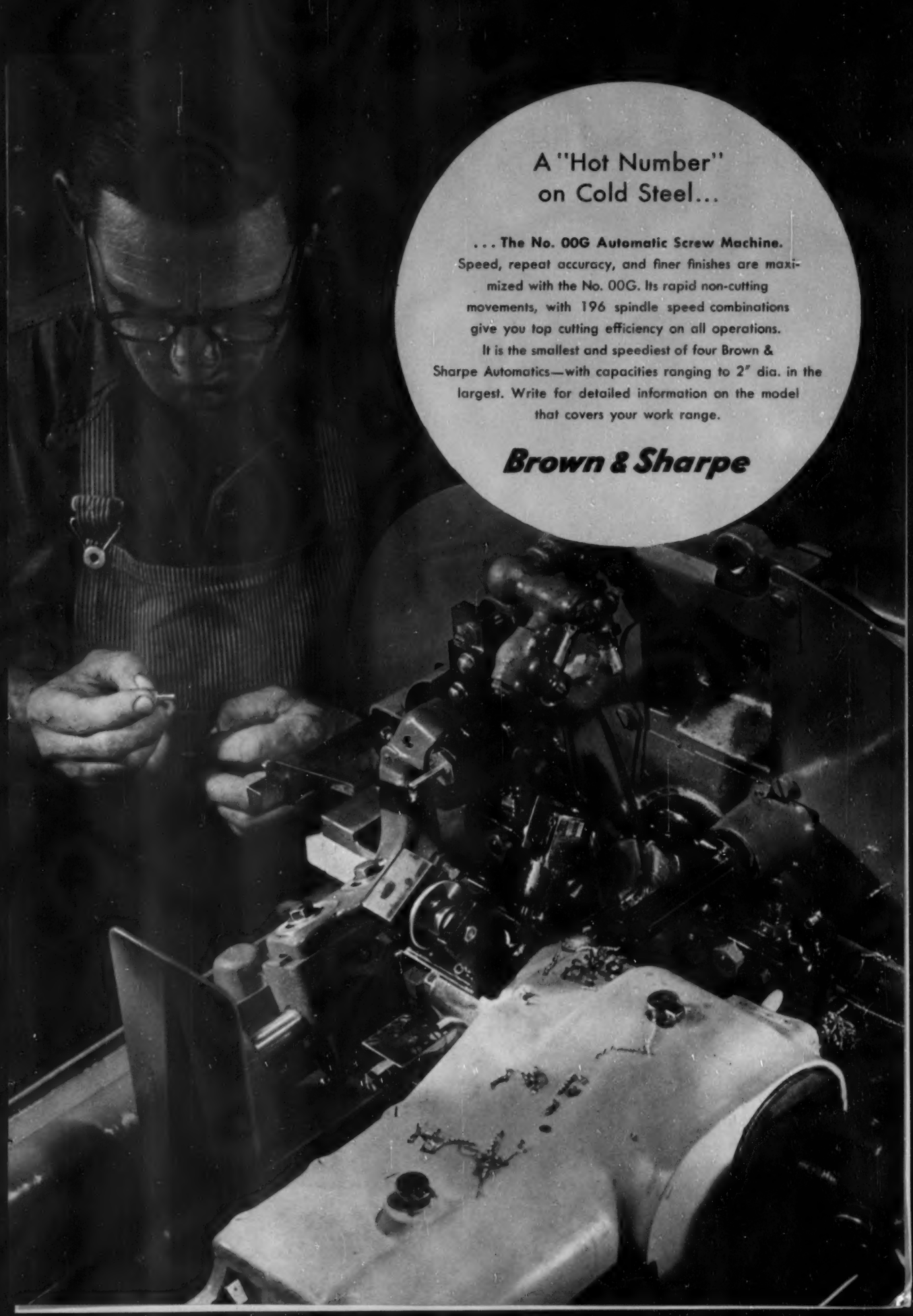
Solenoid Controlled Pilot Operated 4-Way Valve

Traverse and Feed Cycle Control Panel

Balanced Piston Type Relief Valve

6684

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921



A "Hot Number" on Cold Steel...

... The No. 00G Automatic Screw Machine. Speed, repeat accuracy, and finer finishes are maximized with the No. 00G. Its rapid non-cutting movements, with 196 spindle speed combinations give you top cutting efficiency on all operations. It is the smallest and speediest of four Brown & Sharpe Automatics—with capacities ranging to 2" dia. in the largest. Write for detailed information on the model that covers your work range.

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Set 'em and Forget 'em...

... Brown & Sharpe Screw Machine Tools. Rigidly retain their original settings on piece after piece ... even on long-run jobs ... for the closer limits and finer finishes you require. Their simple, modern design speeds set-ups and adjustments ... cuts non-productive time. Get all the facts on this line of over 500 tools for the widest variety of screw machine jobs. Write for new catalog 35 S.

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ANACONDA METALS AT WORK

A special alloy wire goes into the G-E SLEEP-GUARD Blanket . . . sheet brass into the Westinghouse Thermometer Set . . . and Everdur Copper-Silicon Alloys into the Sherwood Valve.

Shut-eye's safer with new shut-off control

Ahhh, sleep... it's wonderful! And now because of G. E.'s new SLEEP-GUARD Wiring System—made of two spiral wires separated by a nylon sheath—sleep's safer, too. If the heating wire becomes too warm, the nylon sheath—along with the heater and signal wire—automatically turns off your blanket. Both wires are made of Hitenso*, a cadmium bronze which provides just the right electrical and mechanical properties. We process almost 100 copper alloys into wire in a wide variety of sizes and shapes, tempers and finishes.

A million at one clip for Betty

Anyone who's ever settled down before a TV set needs no introduction to charming Betty Furness of Westinghouse Studio One fame. Betty's currently offering her vast viewing audience this handy Westinghouse Kitchen Thermometer Set at a bargain price. And Westinghouse expects an overwhelming response. That's why they had Chaney Mfg. Co., Springfield, Ohio, make a million of these sets at one clip. And speaking of clips, those attached to these thermometers are made of coiled brass strip in the most economical alloy, gage and temper.

Vive le valve plug!

The Aluminum and Brass Co., Lockport, N. Y., calls this valve plug—which employs a nylon insert and operates under pressures up to 3,000 psi—the "heart" of their Sherwood Oxygen Valve. We're mighty proud about their enthusiasm, since the plug is made of one of our Copper-Silicon Alloys. Everdur*-1015 was chosen because roll-threading not only frees it from burrs but also work-hardens its surface, making it less likely to wear, gall or "freeze." Everdur-1015's cold-working properties also allow it to be rolled *over* the nylon insert. A tight "cap" results.

Want more information?

Our Technical Department's wide range of experience covers virtually the entire field of copper and copper-alloy applications in industry. If you have a problem of metal selection, we are at your service. *The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.*

*Reg. U. S. Pat. Off.

5496

ANACONDA®

the name to remember in

COPPER • BRASS • BRONZE

from **American Machinist** to **you** this year:

26 sharp-focused issues... packed with the indispensable help and ideas that

Every other week, your copies of *American Machinist* bring you the top ideas and facts we can find on how to manufacture better metalworking products more efficiently. They are the kind of ideas and facts which are important enough to have long-lasting value . . . and you confirm this by asking for more than 300,000 reprints of *American Machinist* articles a year.

How, then, we have long asked ourselves, can the great wealth of information a year's issues of *American Machinist* provide be made as *easily* and *permanently* available to you as possible? And *this* is the year in which the best answer we've ever found is coming your way in our November PRODUCTION PLANBOOK issue. Look at this!

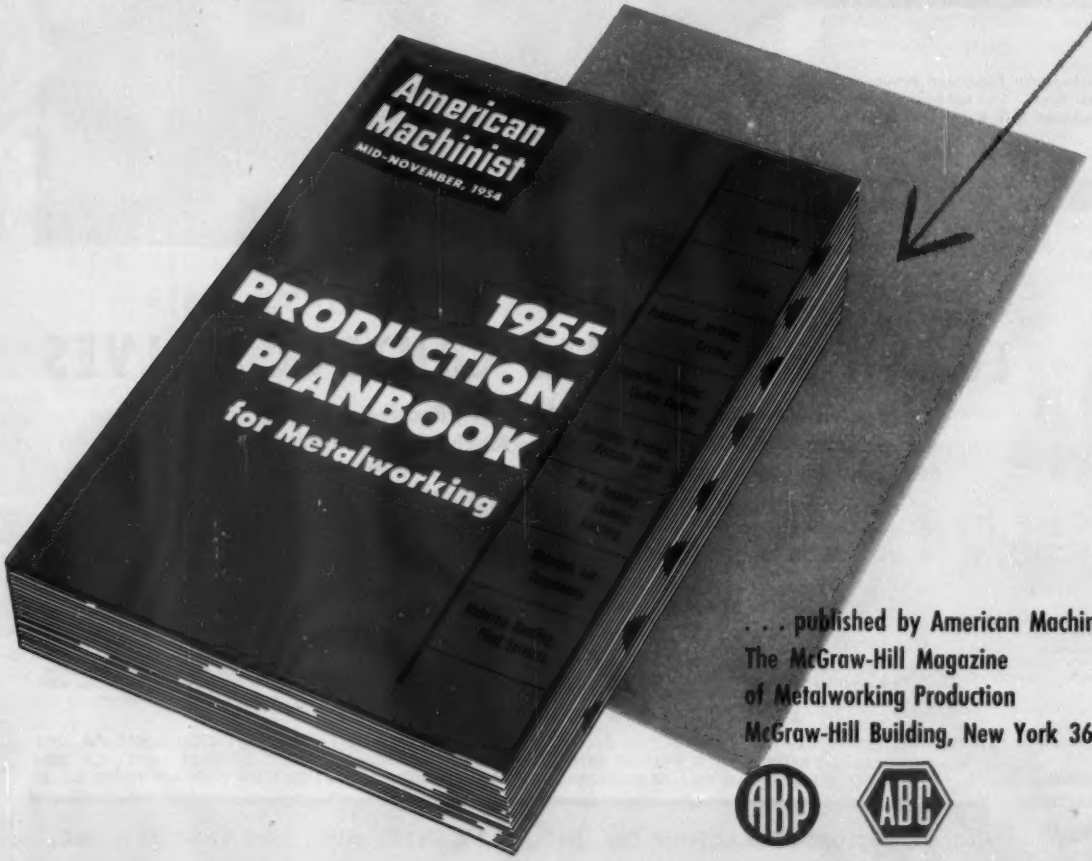
In eight cohesive, carefully indexed sections, the 1955 PRODUCTION PLANBOOK will give you in *very brief form* (no more than a short paragraph per item in most instances) all the important leads to better production that a full year of *American Machinist* issues have brought you in detail. The result will be very much as though, all through the year, you'd made an index-card summary of every *American Machinist* article . . . and filed it away on your desk top for the indispensable help it could offer in solving your daily production problems.

Machining . . . tooling . . . materials . . . finishing . . . heat-treating . . . *whatever* the problem today or tomorrow brings, you'll find an answer or an important clue to its solution in one or more of the PRODUCTION PLANBOOK's eight cohesive sections.

Eight sections we said? Actually, there are ten . . . but the other two will be devoted to *special* PRODUCTION PLANBOOK reports on subjects of high and lasting importance to you. More about them in later issues of *American Machinist* . . . but know *now* that the magazine whose helpful value draws far more subscribers than any other metalworking magazine published is on its way, with the 1955 PRODUCTION PLANBOOK, to being a more helpful, time-saving publication than ever!

make American Machinist the No. 1 magazine of metalworking production

a great **PRODUCTION PLANBOOK** issue
designed to give you more ideas in less time
than any magazine issue has ever offered before



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The McGraw-Hill Magazine
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ABP ABC

LOGAN . . . a national participant in major fluid power advancements

SINCE 1916

Indianapolis Speedway Memorial Day 500-Mile Race . . . national classic viewed by spectators from every part of the world.

LOGAN HYDRAULIC CONTROL VALVES

Illustrated, Model 4015—4-way, 2-position valve for directing pressure alternately to ends of double-acting hydraulic cylinder.

A broad range of types and sizes to most effectively meet any requirement—Design Engineers, Machine Operators, Maintenance Men appreciate these Logan advantages

- LONG-LIFE CONSTRUCTION
- EASY TO SERVICE
- INFREQUENT MAINTENANCE
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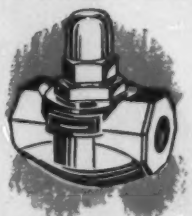
Let Logan Engineers help you design your Air and Hydraulic Circuits



Illustrated, Model 8015 adjustable speed control valve. Install between operating valve and one end of cylinder to meter flow of oil in one direction with free flow on return.

LOGAN MANUFACTURES 6,975 STANDARD CATALOGED ITEMS

FREE CATALOG ON REQUEST

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HYDRAULIC CYLINDERS, Cats. 200-2; 200-3 • HYDRAULIC POWER UNITS, Cat. 200-1 • SURE-FLOW COOLANT PUMPS, Cat. 62

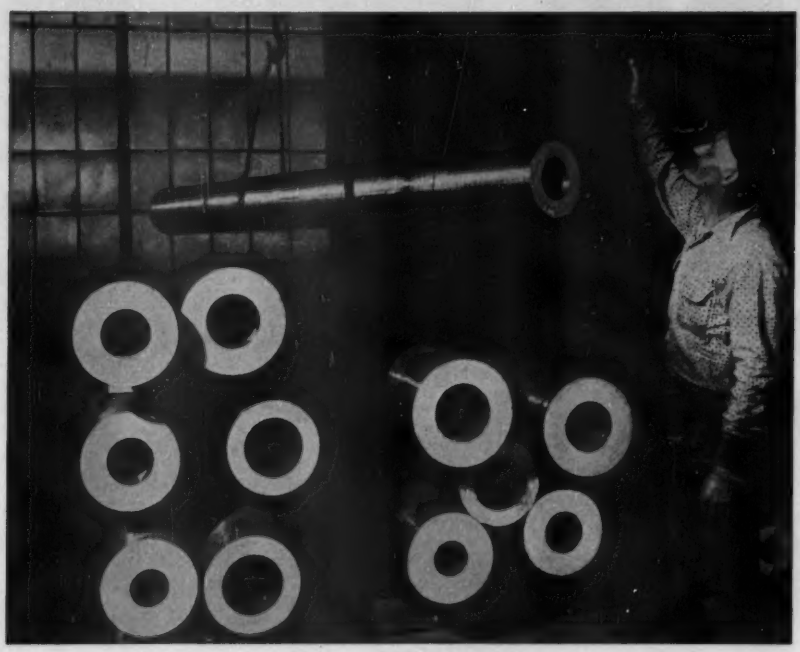
SAVES TIME — Logan — AIR AND HYDRAULIC EQUIPMENT — EFFORT-MOTION

LOGANSPORT MACHINE CO., INC., 818 CENTER AVE., LOGANSPORT, IND.

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation



New Tool Steel Saves Production Time

BTR HOLLOW-BAR IDEAL FOR ALL RING-TYPE APPLICATIONS

Making ring dies? Draw rings? Ring gages? Back-up rings? Then you'll want to use BTR Hollow-Bar, a new Bethlehem tool steel which is especially designed for this type of service.

BTR stands for "Bethlehem Tool Room," our popular oil-hardening tool steel. BTR Hollow-Bar is made by an improved Bethlehem process called High-Speed Trepanning. By this method, the center metal of the hammer-forged round bars is cored out and the bars are then rough-turned on the outside.

BTR Hollow-Bar saves production time and delivery time because your distributor can cut off rings from the bar to any desired length. It also enables you to save shop time, because there's no need to wait for forged rings or discs. What's more, in most instances there's no drilling, rough turning, rough boring, or rough-facing required.

BTR Hollow-Bar is furnished in the annealed condition to a Brinell of 202 max, and is smooth-machined on both the inside and outside surfaces. Stock lengths for small sizes are 6 ft to 8 ft, and for large sizes 8 ft to 12 ft.

Typical Analysis

Carbon	0.90	Chromium	0.50
Manganese	1.20	Tungsten	0.50
	Vanadium	0.20	

If you'd like to know more about Hollow-Bar, talk it over with your distributor. Or write to us at Bethlehem, Pa.

66 HS MACHINES CAR WHEELS

Here the rim contour and front face of a "one-wear" wrought-steel freight-car wheel are being machined. The average depth of cut is 1/32 in. Both the roughing and finishing tools used in this machining operation are made of Bethlehem 66 HS. This is our moly-tungsten grade of high-speed tool steel. In addition to featuring wear- and shock-resistance, 66 HS also has good red-hardness.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

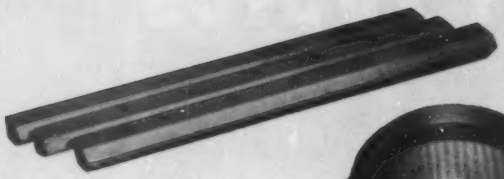
It Doesn't Pay to Punch All the Way Through

One of the best ways to improve the tool life of punches is to control the stroke of the punch. It is not necessary for a punch to go completely through the hole. When a punch does go through the hole, rapid wear occurs. This increases clearance, which in time increases the load necessary for punching, and results in burred edges.

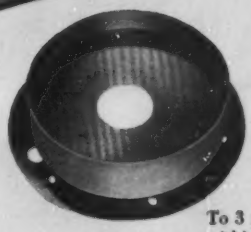
When a punch has penetrated part way through the stock, "snapping" occurs and the "button pops out." The amount of penetration of punch before "snapping" takes place depends upon the material being punched, and the stock thickness. In general, the softer the material the greater the penetration required; conversely, a hard or brittle material requires less penetration.

The penetration on soft, thin stock may be as high as 90 pct of the stock thickness. On hard, thick stock it may be as low as 40 pct. The least amount of penetration which will bring out the "button" is best. What the penetration should be must be determined on each job.

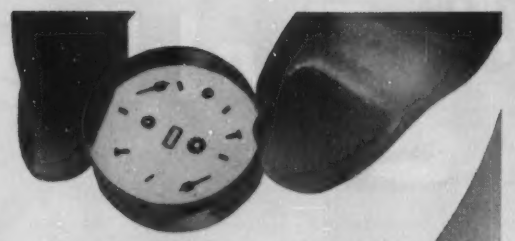
Proper control of penetration of the punch by adjustment of the stroke of the press will pay off in decreased wear on the punch, resulting in better quality parts and increased tool life.



Hardened steel machine tool ways, 2½" x 3½" x 50", ground on 6 sides, flat within .001" with surface finish of 5 micro-inches—*5 times faster than other methods!*

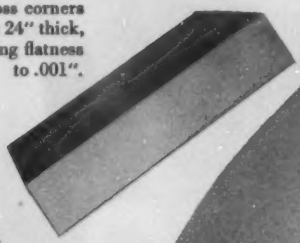


To 3 micro-inches and flat within *one* light band.

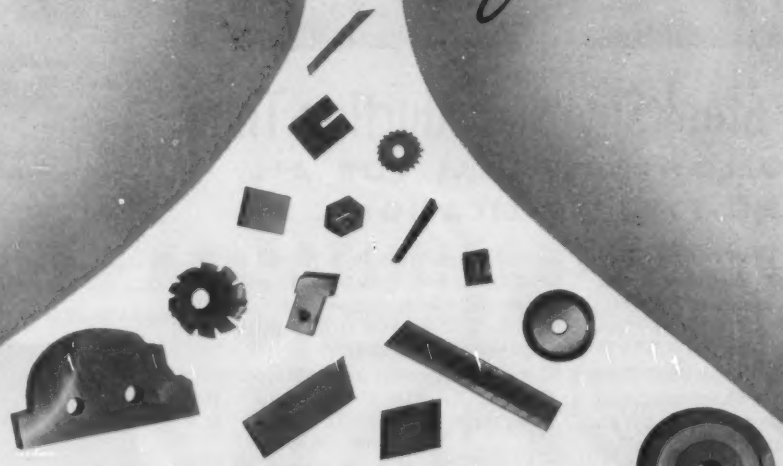


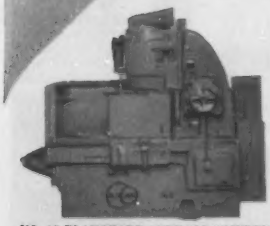
Tiny watch gears, pinions and ruby bearings—flat and parallel—to a dimension tolerance of .0002".

Die plates, 84" across corners and perhaps 24" thick, holding flatness to .001".



"Specs" like these call for Blanchard





NO. 18 BLANCHARD SURFACE GRINDER

Every day, parts like these are ground accurately and rapidly on Blanchard Surface Grinders equipped with Blanchard Abrasive Wheels. They're ground economically too—at costs which help you set competitive prices.

Send a sample of your parts for free test grinding and recommendations.

Send for your free copies of "Work Done on the Blanchard", fourth edition, and "The Art of Blanchard Surface Grinding".

PUT IT ON THE BLANCHARD

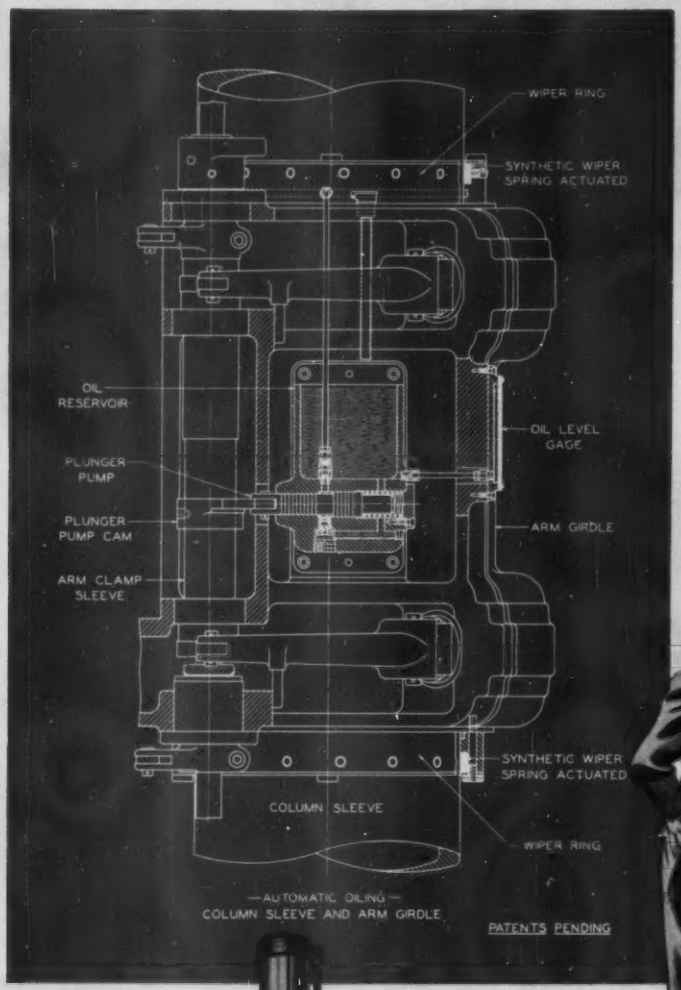
THE BLANCHARD MACHINE COMPANY

64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

Just a memory now

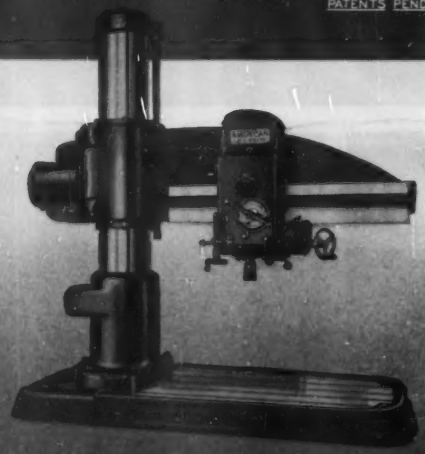
Column Scoring a thing of the past...

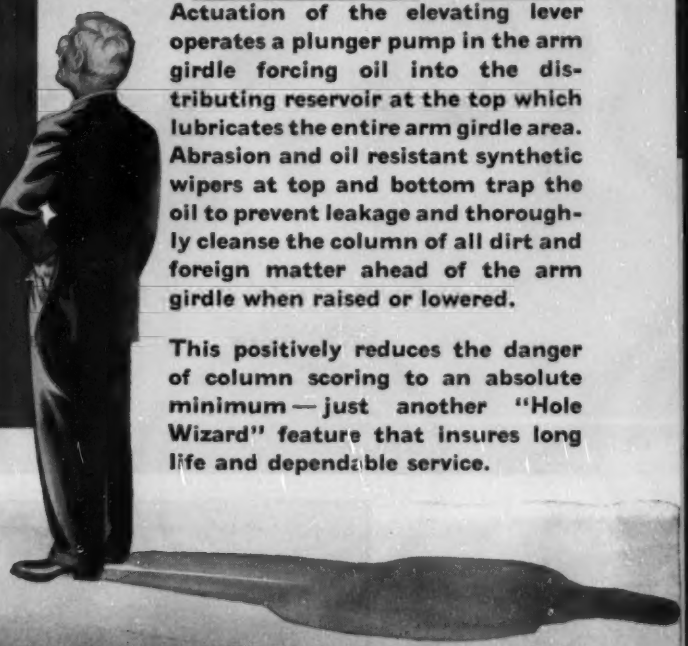
We've done something about it—



On the new "AMERICAN" Hole Wizard Radial the arm girdle and its mating column area are automatically oiled and cleansed. Actuation of the elevating lever operates a plunger pump in the arm girdle forcing oil into the distributing reservoir at the top which lubricates the entire arm girdle area. Abrasion and oil resistant synthetic wipers at top and bottom trap the oil to prevent leakage and thoroughly cleanse the column of all dirt and foreign matter ahead of the arm girdle when raised or lowered.

This positively reduces the danger of column scoring to an absolute minimum — just another "Hole Wizard" feature that insures long life and dependable service.

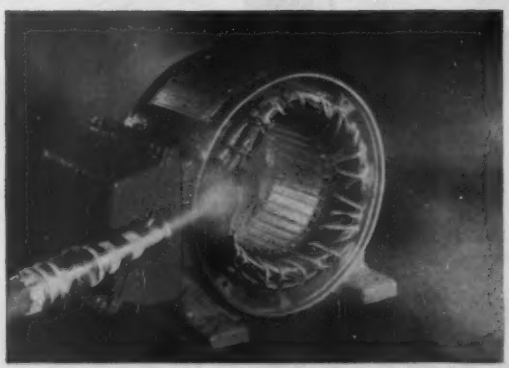




THE AMERICAN TOOL WORKS CO.

Cincinnati, Ohio, U. S. A.

LATHES AND RADIAL DRILLS



Here's a Life-Line "A" stator that has been given multiple dips and bakes of Bondite. There is no evidence of vapor penetration after being exposed to the toughest insulation test—a jet of steam.

Try tearing a piece of Life-Line's slot insulation, Mylar*. Mechanical strength is eight times greater than ordinary slot cells. Dielectric strength is ten times greater than standard design requirements.

*Trade Mark for Du Pont polyester film

There's more to motor insulation than its ability to repel water

These demonstrations show how new Life-Line A insulating materials provide greater protection for wire, slots and complete stator.

New and improved motor insulations are the word of the day. Actually, there is a considerable range between the run-of-the-mill "improved" insulations and the really outstanding types now available. There is only one way to judge them—by comparison.

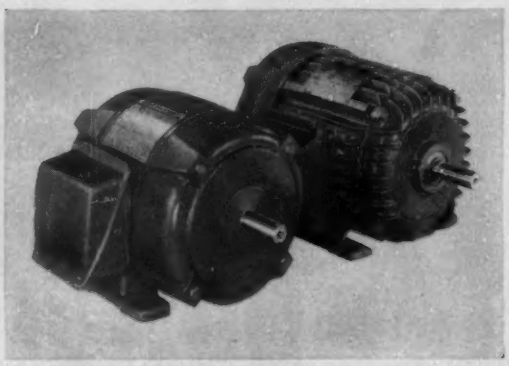
For example, many new stator insulations do a more effective job of shedding water. But Life-Line's® new Bondite goes a step further . . . it repels vapors that penetrate ordinary water-shedding insulations.

The secret is in the silicone additive that is impregnated throughout Bondite instead of being just applied as a thin outer layer. The complete story of Life-Line's Bondite, Bondar and other new motor improvements is contained in the new Life-Line Booklet B-6154. For your copy, write: Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pa. J-21847-A

YOU CAN BE SURE...IF IT'S Westinghouse

A duck's ability to shed water is only feather deep. A simple wetting agent dissolves the duck's protective coating and he sinks. Many water-shedding motor insulations react much the same; expose them to a simple solvent and they deteriorate.

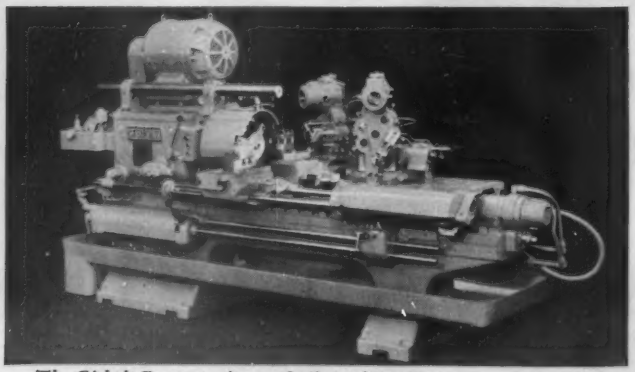
These two coils have been baked for 50 hours at 400° F. Bent around a finger, the ordinary insulation on the right coil flaked off. Life-Line's Bondar insulation on the left remained intact.



Dependable performance takes balanced design. That's why *every* component in the new Life-Line "A" has been redesigned and integrated with the whole. The result is a motor with superior performance.

from 41.9 Minutes down to 15 Minutes

That's Productivity with the GISHOLT FASTERMATIC



The Gisholt Fastermatics are built in three sizes ranging from 21" to 36½" swing over bed.

The cost of machining these gear blanks at the Falk Corp. took a sharp drop when the Fastermatics took over. Time was cut nearly two-thirds. Moreover, human errors were eliminated, thanks to Fastermatic's ability to hold close tolerances.

One operator tends 2 Fastermatics and a honing machine. Simple tooling makes it possible to handle 9 different sizes of gear blanks.

These modern automatic turret lathes enable you to handle a larger number of operations in one chucking—and cut costs to the bone on a wide variety of work. Ask for facts about them.

THE GISHOLT ROUND TABLE
represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

"STANDARD for tough jobs since 1881"

Red Shield says:

Call your Industrial Supply Distributor for Shield Brand Slitting Saws.
Specialized factory service available everywhere.

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FACTORY BRANCHES IN: NEW YORK • DETROIT • CHICAGO • DALLAS • SAN FRANCISCO

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Mattison Grinder beats old time (15 hours) by 12 hours

The picture above shows a punch and die grinding operation on a Mattison High-Powered Precision Surface Grinder at Lyon Metal Products, Incorporated. Previous time on a converted planer-grinder was 15 hours — now with a Mattison Grinder equipped with special fixture, grinding time has been reduced to 3 hours.

Mattison Grinders are proving profitable investments in plants where "time out" for reconditioning is a vital factor in meeting production schedules. Surfaces are reconditioned and edges sharpened in a minimum of time, eliminating costly delays and holdup of production. Many manufacturers installing the Mattison Grinder for reconditioning dies find many other uses for it in grinding flat surfaces where accuracy and fine finish are required. For complete information on the Mattison High-Powered Precision Surface Grinder, send for free copy of our latest circular.

MATTISON MACHINE WORKS
ROCKFORD · ILLINOIS

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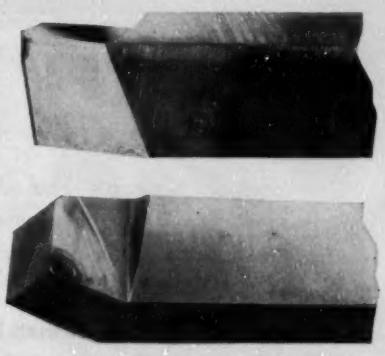
Stuart'S CUTTING OILS

balanced for your particular operations

● What is your operation? Gear shaping, high speed automatics? No matter . . . because Stuart Oil Company has balanced cutting oils for you . . . with just the right amount of lubricity, temperature control and chemical activity to provide you with the optimum in finish, production and tool life.

Stuart's Balanced Cutting Oils are made under laboratory control. You are assured of a uniform product that will provide consistent results. It is not a so-called "all purpose" cutting fluid but an oil that has been specifically blended to produce the very best results obtainable under the conditions you will subject it to.

Perhaps you are blending your own cutting oils now . . . or using other types. Letting a Stuart Representative, "the Man in the Barrel", explain and demonstrate a balanced Stuart Cutting Oil, may bring you new savings in time, money, worry and a quality improvement in your product. Fill in the coupon below today. Ask to have "the Man in the Barrel" call on you.



The cutting tool at top shows an abnormal front clearance caused by excessive *chemical activity* of cutting fluid. The lower cutting tool shows cratering, usually associated with poor finish, resulting from insufficient *chemical activity* of cutting fluid used.

More than a "Coolant" is Needed

D. A. Stuart Oil Co.
EST 1865 LIMITED

TIME-TESTED CUTTING FLUIDS AND LUBRICANTS

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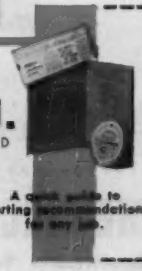

A quick guide to starting recommendations for any job.

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☐ Please have "the Man in the Barrel" call.

☐ Please send a Stuart's Cutting and Grinding Fluid Selector and Dilut-O-Graph Folder.

Name .....

Title .....

One of 7 Super Service Radials in use at Solar Aircraft's Des Moines plant.

Photos courtesy Solar Aircraft Company, Des Moines, Iowa.

"well pleased..."

"Our production people and our plant engineering department, who install and service equipment, are well pleased with our Cincinnati Bickford drilling machines." • **Solar Aircraft Company**

Both large and small Cincinnati Bickford Super Service Radial Drills are used here in producing jet engine components. The arm of the machine shown above is swinging over two working positions permitting the completion of all drilling operations at both stations with a minimum of work handling. Altogether there are 10 holes drilled and reamed, 18 holes drilled and tapped, and two .656" dia. half moon radii accurately machined in this tough high-alloy steel. The accuracy, speed and trouble-free performance, the power and easy control of these machines have made them popular to both engineers and operators.

Write for Catalog R-29.

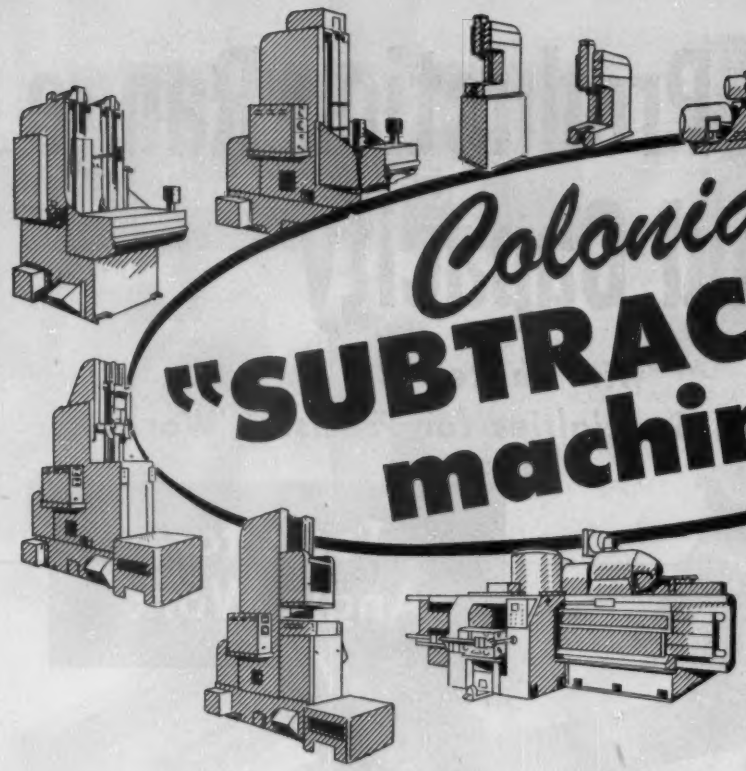
80 YEARS OF SERVICE

CINCINNATI BICKFORD

RADIAL AND UPRIGHT DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO.

Cincinnati 9, Ohio, U.S.A.



Colonial "SUBTRACTING" machines

they subtract production costs ...add to profits

Subtraction #1—the *Broach.* With the Colonial broach designed specifically to broach the part efficiently to the tolerances specified at the required rate of production, cost subtraction starts.

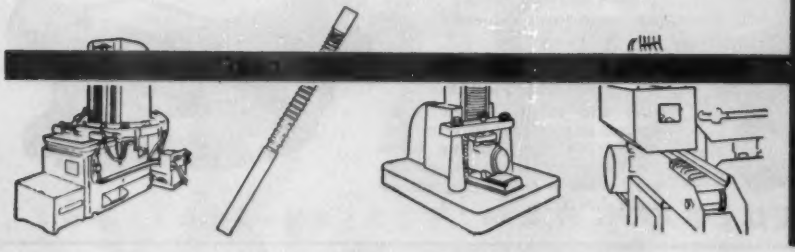
Subtraction #2—the *Machine.* Selecting one of the more than 60 dependable Colonial broaching machines capable of handling the broach at the specified rate of production is the next important step in subtracting costs.

Subtraction #3—the *Fixture.* The Colonial fixture, locating and clamping the part in broaching position, while at the same time permitting maximum accessibility for loading and unloading, is another important step in cost subtraction.

Subtraction #4—the *Automation.* Where high production requirements make loading and unloading time an important factor, the Colonial automation of the broaching installation will serve to further subtract machining costs.

ADDITION—By adding the four important Colonial cost subtracting features above, today's cost conscious metalworking plant has a complete *Colonial Unified Broaching Installation* capable of producing the part at lowest possible cost with utmost accuracy. To subtract costs and add to profits in your plant, ask Colonial Broach to quote on Unified Broaching installations for your parts.

Ask for bulletin 877 on complete line of Colonial broaching machines



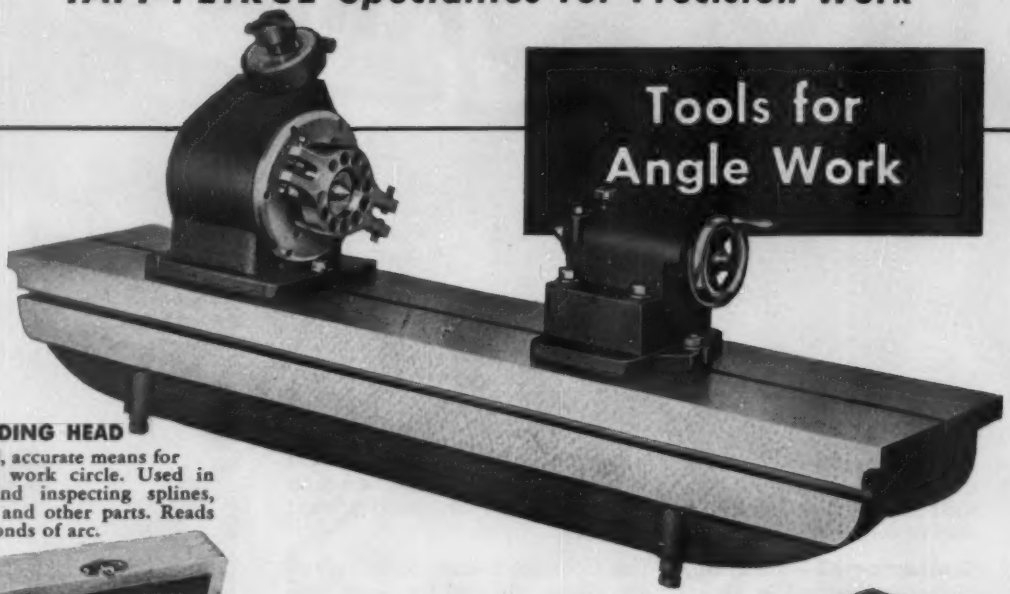
Unified Broaching

COLONIAL

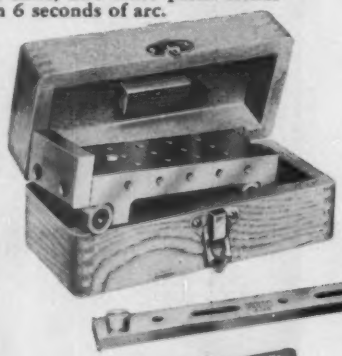
Increase Production Range and Capacity

with these

TAFT-PEIRCE Specialties for Precision Work

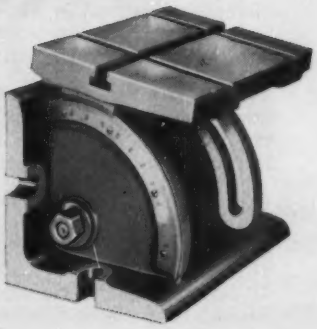


T-P DIVIDING HEAD
offers a rapid, accurate means for dividing the work circle. Used in measuring and inspecting splines, gears, cams, and other parts. Reads within 6 seconds of arc.



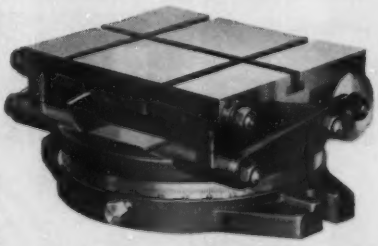
T-P SINE BARS & SINE BLOCKS
First conceived and built by Taft-Peirce, they locate work to any given angle within very close limits. Tapped holes permit clamping.

T-P TOOLMAKER'S ADJUSTABLE KNEE
simplify inspection or setup of angular work. Graduated quadrant and vernier reads to 5 minutes of angle.

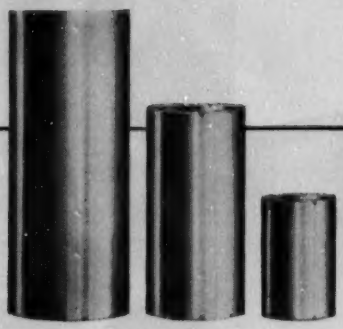


T-P ANGLE BLOCKS
speed setup and grinding of small angular work on a magnetic chuck. Can be used individually or in any combination to form V-blocks.

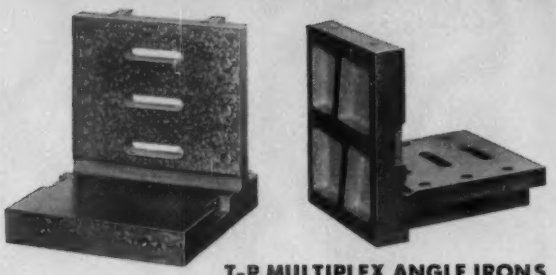
T-P ADJUSTABLE ANGLE PLATE
tilts and turns. Makes compound angles easy to setup for machining. Both tilting table and rotating base are graduated from 0 to 90 degrees in each direction.



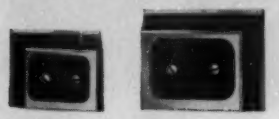
Reference Surface Tools



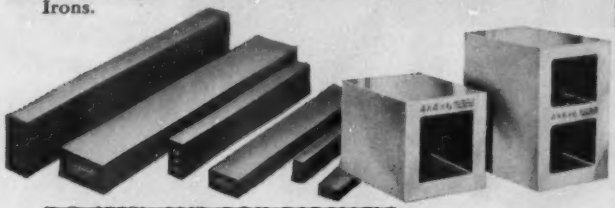
T-P CYLINDRICAL SQUARES
Used with T-P Surface Plate they provide a convenient, accurate reference line for any vertical work-surface.



T-P MULTIPLEX ANGLE IRONS
All surfaces are scraped accurately flat for faster, easier setups. Other types available include Duplex Angle Irons, Slotted Angle Irons, Toolmaker's Knees, and Measuring Irons.



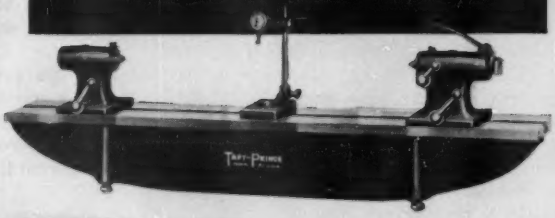
T-P UNIVERSAL SQUARES
High precision squares that can be used in any position. Hard rubber center facilitates gripping . . . prevents hand heat from reaching block.



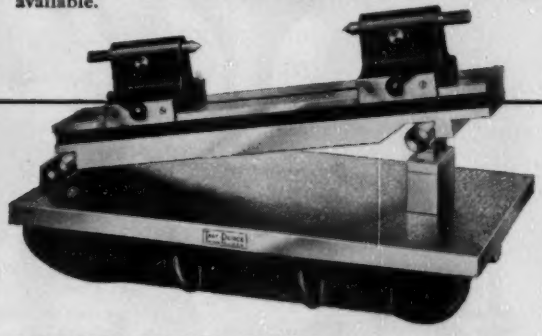
T-P STEEL AND BOX PARALLELS
are available in a complete line of stock sizes. Also, Planer and Boring Machine Parallels, Levelling Straight Edges, and Steel Straight Edges.

T-P SURFACE PLATES
Extremely fine grain of T-P granite surface plates gives smoother more wear-resistant surface, assures top precision over longer periods. Cast Iron surface plates also available.

Versatile Inspection Tools



T-P BENCH CENTERS
simplify inspection work. Have unusual rigidity and permanent accuracy. This is typical of a wide range of inspection tools available at Taft-Peirce.



T-P TAPER TESTING FIXTURE
combines a Sine Block with a pair of adjustable mounted precision centers. Checks tapers to high degree of accuracy.

For the complete story on these items and many more, get your copy of the Taft-Peirce Handbook.

T-P COMPARATOR SQUARE
permits, accurate indication of squareness. Adaptable to both production and inspection work.

T-P means Top Precision

THE TAFT-PEIRCE MANUFACTURING COMPANY
WOONSOCKET, RHODE ISLAND

ARMSTRONG

Quality TOOLS

NOT A COST, BUT AN INVESTMENT

That Pays Year After Year . . .

Buy ARMSTRONG TOOL HOLDERS and TOOLS for today's jobs and they will bring you added profits thru the years. With ARMSTRONG TOOL HOLDERS you will be permanently tooled up for whatever comes, for each is a multi-purpose tool that takes cutter bits ground to many shapes. Each is an efficient tool, refined thru a half century of world wide use. Each has strength beyond any need, extra strength resulting from endless research and the most modern closely controlled manufacturing methods.

ARMSTRONG TOOL HOLDERS are inexpensive too, for they are produced in great numbers. They are instantly available because they are carried in stock by all leading supply houses in sizes and types for every operation on lathes, planers, slotters and shapers; for standard operations on turret lathes and screw machines. They are profitable in use because they permit the highest speeds and heaviest feeds and "Save: All Forging, 70% Grinding and 90% High Speed Steel."

ARMSTRONG Lathe and Milling Machine Dogs are permanent tools too. They are drop-forged from special open hearth steel, are heat treated to extreme stiffness and toughness. They have alloy steel screws hardened at the tip to prevent up-setting and have double life, for hubs are made oversize to permit re-tapping.

ARMSTRONG Quality pays back over and over again. *Write for new S-48 catalog.* It offers many opportunities to conserve profits.

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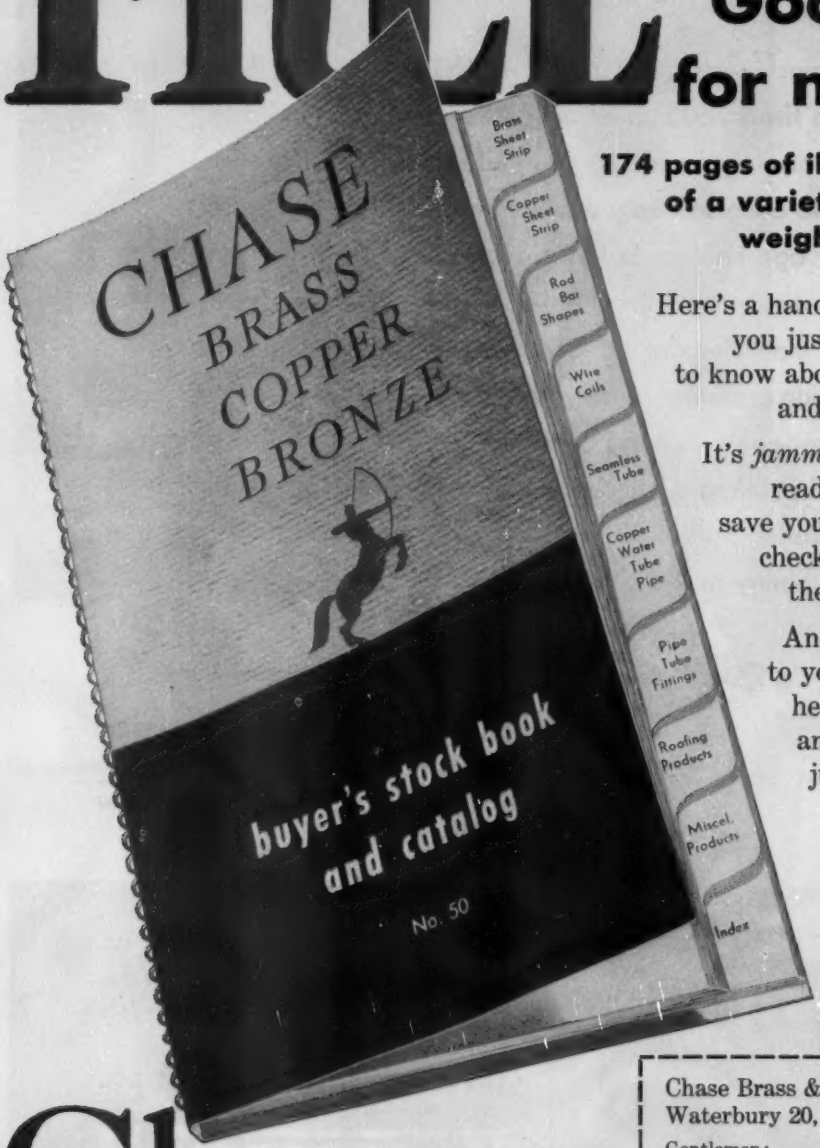
Good reading for metal men!



174 pages of illustrations and listings of a variety of products...sizes... weights...tempers...shapes!

Here's a handy, desk-size book that gives you just about *everything* you need to know about brass, copper and bronze and now . . . stainless steel, too!

It's *jammed to the brim* with easy-to-read data. It's *thumb-indexed* to save you time. It has a how-to-order check list that's designed to take the headaches out of ordering.

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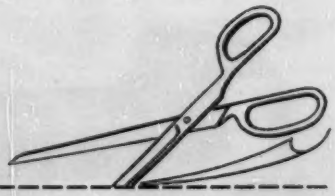

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DO YOUR MILLING MACHINES POSE SERIOUS '54 DOLLAR-QUESTIONS?

Are your milling machines OLDER THAN YOU THINK? Are they costing you **more than you can afford?** • Recent surveys indicate many thousands of millers over 10 years old . . . and some even younger . . . have been so badly overworked that they are much older than their age implies. In terms of production efficiency, it would pay to "retire" them. Precision-wise and cost-wise, many "good looking" machines are dangerously **too old** to compete in today's production economy. • Are your milling machines wastrels? Are they squandering dollars? Are they an "iron curtain" between you and profitable sales in today's competition? Wouldn't you consider abler replacements, as a sensible investment, to increase your ability to produce at a profit?

• *You'll find* sound answers to these 1954 dollar-questions in our BULLETIN* on the new

IMPROVED TYPE "G" KEMPSMITH MILLING MACHINES

. . . free from cost-adding non-essentials . . . fortified with practical performance advantages . . . economical in first cost and maintenance . . . RIGHT for toolroom, maintenance, job shop and general precision production operations.

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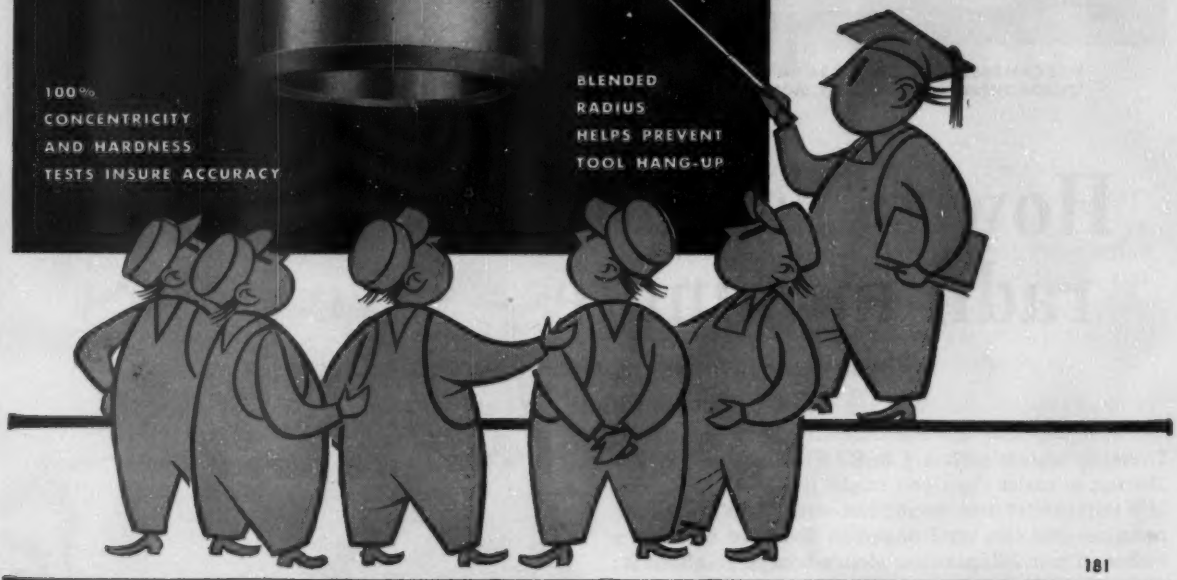
INSURE PERFECT ALIGNMENT AND LONG LIFE OF PRODUCTION TOOLS

KNURLED HEADS PROVIDE GOOD GRIP
SUPERFINISH BORES REDUCE TOOL WEAR
100% CONCENTRICITY AND HARDNESS TESTS INSURE ACCURACY
BLENDED RADIUS HELPS PREVENT TOOL HANG-UP

Universal Drill Bushings are available in a complete range of standard sizes and lengths. Special sizes made to order. Write to Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wis.; or the home office.



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UNIVERSAL ENGINEERING COMPANY
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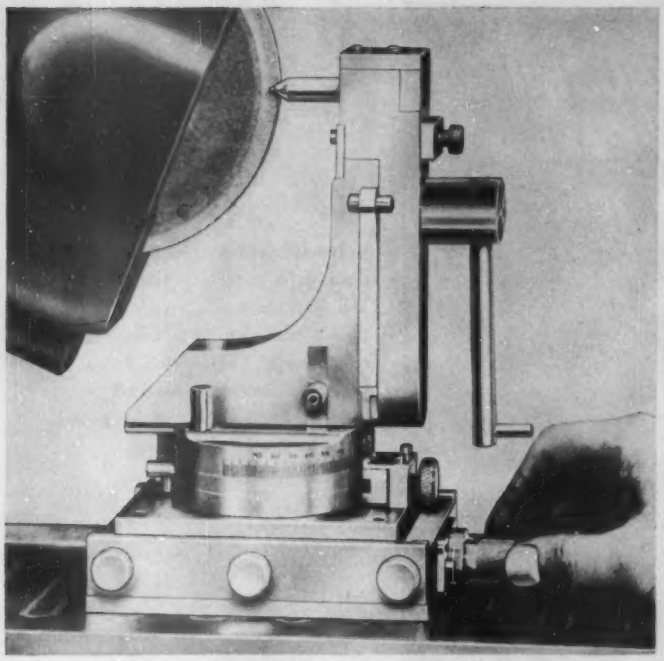
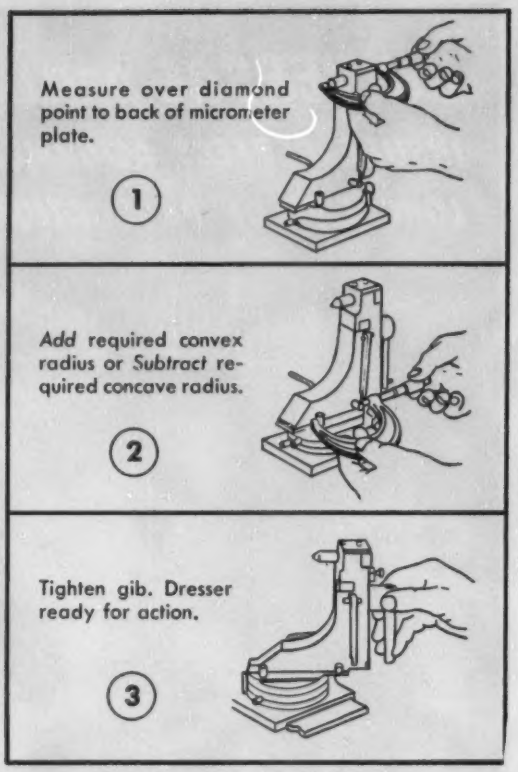
1 STANDARD COLLET CHUCK
2 FLOATING COLLET CHUCK
3 BORING CHUCK
4 "KWIK-SWITCH" TOOL HOLDER
5 MIKRO-LOK BORING BAR
6 STANDARD DRILL BUSHING
7 UNIVERSAL INDEX PLUNGER



YOU CAN DRESS WHEELS UP TO 24" IN DIAMETER WITH J & S "FLUIDMOTION" WHEEL DRESSERS. MODEL REC SHOWN HERE.


Measure over diamond point to back of micrometer plate.
1
Add required convex radius or Subtract required concave radius.
2
Tighten gib. Dresser ready for action.
3

How to set angles in seconds, radii in minutes—save hours

These easy instructions show you how you can with a J & S "Fluidmotion" Wheel Dresser

Dressing wheels with a J & S "Fluidmotion" Wheel Dresser is easier than you might think. All you need is a micrometer and simple hex wrench. With a little practice, you can set 2 angles in about 10 seconds, a radius in just 2-3 minutes. Here's how to go about it:

To Obtain One Angle

Adjust center line of grinding wheel to height of diamond. The swivel base of the dresser is graduated at 100° on each side of center. Loosen knurled knob and hold both pins which protrude from bottom rings. Then simply set desired angle, tighten the knurled knob, and you're ready for action.

To Obtain Two Angles

Loosen knurled knob and set the pin on the *bottom ring first* for one angle. Then move pin on the middle ring for the other angle. Tighten the knurled knob—that's all there is to it.

To Obtain a Convex Radius on Grinding Wheel

Measure master reading over diamond point to back of micrometer plate (drawing #1) . . . for example	2.531"
Add required convex radius (drawing #2)	+ .069"
Setting for micrometer pins	2.600"

To Obtain a Concave Radius on Grinding Wheel

Measure over diamond point to back of micrometer plate (drawing #1) . . . for example	2.900"
Subtract required concave radius (drawing #2)	−2.142"
Setting for micrometer pins	.758"

Tighten gib. Dresser now ready for action (drawing #3)

How much time and trouble can a J & S Wheel Dresser save you? Figure it up. Then write us for complete information.

J&S TOOL CO., INC.

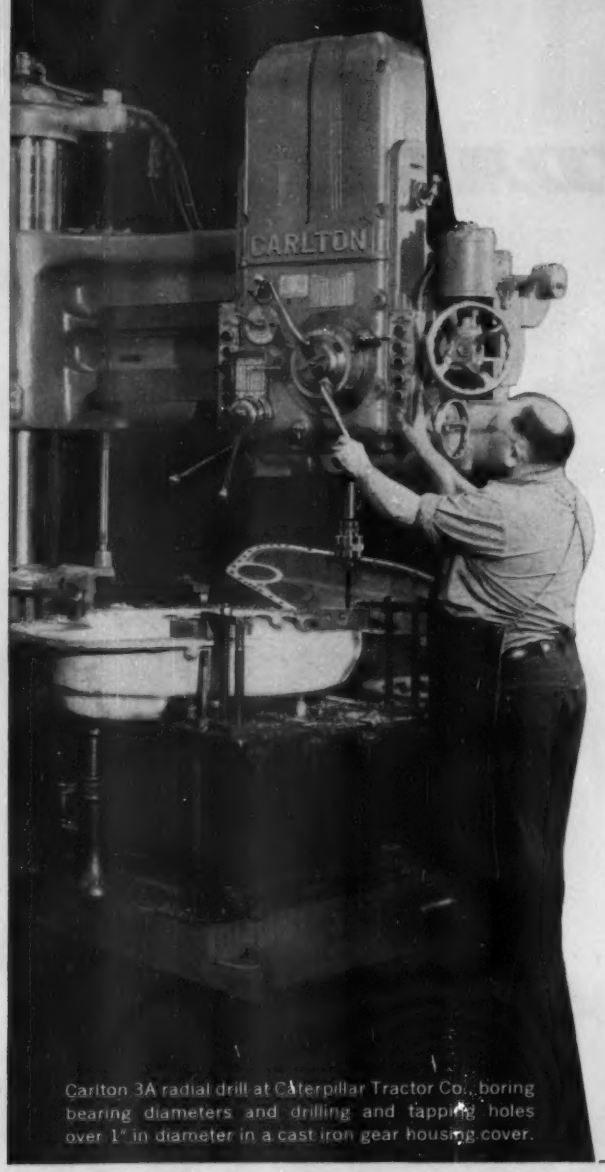
WHEEL DRESSERS • JAW CLAMPS • PRECISION VISES • SINE BARS • DOWN-HOLDING DEVICES

646 W. Mt. Pleasant Ave., Livingston, New Jersey

Caterpillar®

gets fast, accurate, heavy duty drilling with

Carlton
radial drills

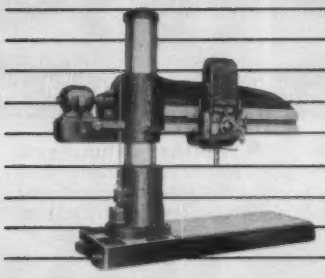


Carlton 3A radial drill at Caterpillar Tractor Co., boring bearing diameters and drilling and tapping holes over 1" in diameter in a cast iron gear housing cover.

Drilling at Caterpillar Tractor Co. is strictly large scale . . . yet it must be fast and accurate. That's why Caterpillar uses Carlton Radial Drills. Carlton has everything you need for today's hole drilling precision and production: pushbutton control, super-precision column clamp, 3-unit power clamping, low hung drive, positive tooth feed clutch and easy, economical maintenance.

You're sure to find your most economical size here, too, because the Carlton line includes arm lengths from 3-ft. to 12-ft., column diameters from 9" to 26".

Check Carlton . . . the *one* radial drill that assures you of maximum hole drilling production, precision performance today and tomorrow, and owner *and* operator satisfaction. Why not write today for the 'hole' story.



The Carlton Machine Tool Co., Cincinnati 25, Ohio.

The Carlton Machine Tool Co. Cincinnati 25, Ohio

Please send us descriptive bulletins on Carlton radial drills in sizes indicated:

Arm	Column
____ft.	____in.
____ft.	____in.
____ft.	____in.

Name_____

Company_____

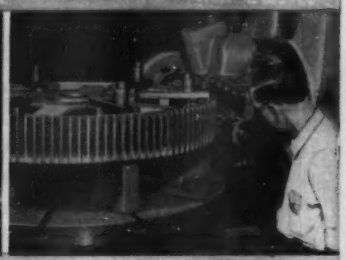
Street_____

City_____ Zone____ State_____

DEPENDABILITY...

■ Minster combination friction clutch and brake. Fast, shockless engagement . . one nut adjustment . . low maintenance.

■ Bearing surfaces of unusual accuracy are obtained at Minster by roll burnishing the machined and ground crankshaft.

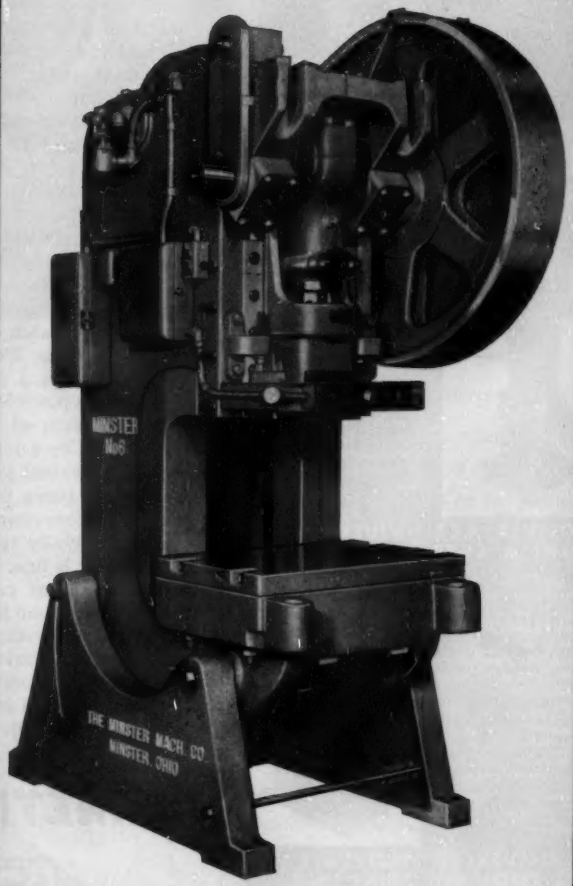


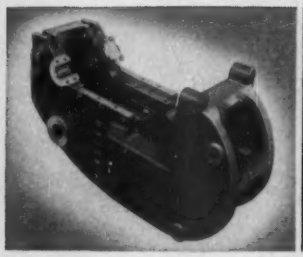
■ Another example of Minster's self-integrated facilities—precision gear hobbing under control of Minster machinists.

you get it with a Minster Press

■ When your machine performance audits are completed you'll find Minster presses rating A's for dependability. Month after month, year after year, Minsters pile up production records worthy of their reputation for being "first in press design."

As the smaller illustrations below indicate one major reason for Minster dependability is attention to *all* the details. The sum total of these details help make a press that has no superior for profitable operation over long periods of time. Next time, specify Minster presses.





■ Heavy frames with extra protection against deflection characterize Minster presses. Here is mass that insures rigidity.

■ Close control of casting quality is demanded in Minster's own foundry. Illustrated: micro-inspection of grain structure.

THE MINSTER MACHINE CO.

MINSTER

FIRST IN **PRESS** DESIGN

MINSTER, OHIO

Keep Your on the OLIVER Line — Cost Cutting Production Boosting MACHINE TOOLS

OLIVER DRILL POINTERS

Properly machine ground drills give better performance. OLIVER Drill Pointers, with each lip doing equal work, give balanced cuts—more accuracy—more perfect holes—more efficiency—longer drill life.

As Illustrated:

No. 21 Oliver Bench Drill Grinder. Hand operated for Drills No. 57 to ½".

No. 510. For Drills ¼" to 3"—2-3-4 flute.

OLIVER DIE MAKING MACHINES

Efficient, speedy and accurate — effecting great savings in time and costs. Skilled labor is not required for sawing, filing and lapping operations.

Available in 5 Models.

Bench Model S-1 (Illustrated) — Single Speed Die Maker for use on Tool Steel up to 1" Thick.

Heavy Duty Model (Illustrated) — 6 speeds, works in metal up to 3" thick, has variable strokes to 5" with hydraulic feed.

OLIVER ACE UNIVERSAL TOOL & CUTTER GRINDERS

Keep your most difficult cutters sharp with Oliver ACES. They excel on high speed and Tungsten-Carbide work. Direct reading for clearances reduces fatigue — eases operators' jobs.

The ACE excels for grinding face mills up to 15" —also, slab mills • slitting saws • all types cutters and reamers.

2 Models: Heavy Duty (Illustrated) and Standard.

OLIVER 20" TEMPLATE TOOL BIT GRINDER

Efficiently powered by a 3 h.p. motor, this OLIVER Machine grinds on the periphery of a 20" wheel. Capacity: tools up to 1½" wide x 1¾ high from 0 to 20 clearance. The OLIVER is developed for production sharpening of single point Tungsten Carbide and high speed tools—offers increased production, lower tool costs and savings in man-hours. Extremely fine finish assured.

Write Today For Complete Information

OLIVER INSTRUMENT CO.

1414 E. MAUMEE • ADRIAN, MICHIGAN

Backlash

EXTRACTS FROM CURRENT LETTERS TO THE EDITORS

Pro and Con

In reference to the article by Mr E J Engle, (*AM*—April 26 '54, p105), I was sorry to see a fine piece of work spoiled by the final paragraph. If he had omitted the part beginning, "One final point," I would have agreed with him wholeheartedly, and I see that Peter Grant (*AM*—May 24 '54 p90) also takes issue with him on this same point. However, I think Mr Grant is distorting the meaning of some of Engle's thoughts.

In the matter of anticipating the wishes of the boss, for example, he is quite correct in stating that a machine operator should not start working on a new batch of work merely because it looks like the previous batch. But such a procedure could scarcely take place in a modern shop because a batch of work is always accompanied by a job order, and the production control system would insure the job being handled righ.

On the other hand, what Engle says about loyalty to the boss and to the company is fine. It is the lack of such loyalty that causes nearly all our so-called labor troubles. If only men would understand, as our grandfathers well understood, that the one who pays the piper calls the tune, our working world would be so much happier a place to live in.

We have heard so much in recent years about rugged individualism that most people have begun to believe that they will lose their self-respect and the respect of their fellow men unless they rear back and proclaim loudly that, "Nobody's going to tell me what to do." That kind of attitude is OK in politics and in your own private life, but when you accept another man's money in return for your services, you have every obligation to do things the way he wants them done and to protect his interests in every way you can. You are working for him of your own free will. If you don't like it you can go somewhere else. That's where the individualism comes in. But just as long as you are working for him, you are morally bound to give him your full efforts and your complete loyalty.

Only in his last paragraph does Mr Engle go beyond the border of normal human behaviour. No one, least of all the boss, would expect a worker to come into his office, confess his sins, and ask for guidance. That sort of thing belongs in the psychiatrist's office or the Sunday school.

Henry Blound
Chicago

Bright Ideas

I have come to the conclusion that you should accumulate items of vital interest that you have published during the past few years, such as the drawing of superfine platinum wire (AM—April 26 '54, p149), and the rolling of ultra-thin nickel-moly

GRINETICS

BY D G SMITH

MAINTENANCE TOOLS

SHAVING MACHINE

WORK-DRIVING DOGS

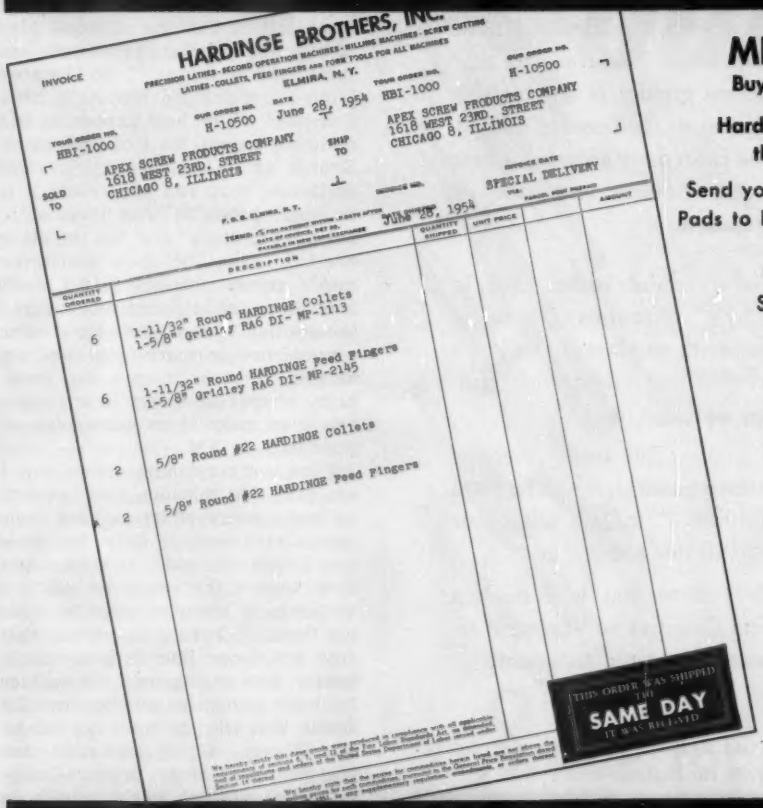
Republication rights reserved

HARDINGE
ELMIRA, N.Y.

Collets
Feed Fingers
Pads

Shipped the Same Day

THIS ORDER WAS SHIPPED THE **SAME DAY** IT WAS RECEIVED



HARDINGE BROTHERS, INC.

PRECISION LATHES - SECOND OPERATION MACHINES - HILLING MACHINES - SCREW CUTTING LATHES - COLLETS, FEED FINGERS AND FORM TOOLS FOR ALL MACHINES

ELMIRA, N. Y.

INVOICE

YOUR ORDER NO. HBI-1000 — OUR ORDER NO. H-10500 — DATE June 28, 1954 — YOUR ORDER NO. HBI-1000 — OUR ORDER NO. H-10500

SOLD TO: APEX SCREW PRODUCTS COMPANY, 1618 WEST 23RD. STREET, CHICAGO 8, ILLINOIS

SHIP TO: APEX SCREW PRODUCTS COMPANY, 1618 WEST 23RD. STREET, CHICAGO 8, ILLINOIS

INVOICE NO. — INVOICE DATE: SPECIAL DELIVERY

F.O.B. ELMIRA, N. Y. — TERMS — DATE OF SHIPMENT, NET 30, PAYABLE IN NEW YORK EXCHANGE — DATE SHIPPED: JUNE 28, 1954 — VIA — PARCEL POST PREPAID

QUANTITY ORDERED	DESCRIPTION	QUANTITY SHIPPED	UNIT PRICE	AMOUNT
6	1-11/32" Round HARDINGE Collets 1-5/8" Gridley RAG DI- MP-1113			
6	1-11/32" Round HARDINGE Feed Fingers 1-5/8" Gridley RAG DI- MP-2145			
2	5/8" Round #22 HARDINGE Collets			
2	5/8" Round #22 HARDINGE Feed Fingers			

We hereby certify that these goods were produced in compliance with all applicable requirements of Sections 6 and 7 of the Fair Labor Standards Act, as amended. The prices stated in this invoice are not in excess of the prices specified by a contract entered into prior to October 1, 1941, under Section 6 of the Act. We hereby state that the prices for commodities herein listed are not above the prices charged by us for such commodities, pursuant to the General Price Regulation, dated [illegible], or any supplementary regulation, amendment, or order thereof.

THIS ORDER WAS SHIPPED THE **SAME DAY** IT WAS RECEIVED

MEMO TO:

Buyers of Collets, Feed Fingers and Pads

Hardinge delivers from stock, quality items that give top performance at low cost.

Send your orders for Collets, Feed Fingers and Pads to Hardinge. Watch for packing lists and invoice with the slogan imprinted

"This order was Shipped the SAME DAY it was Received."

These imprinted forms are symbols of the services from Hardinge that await your orders.

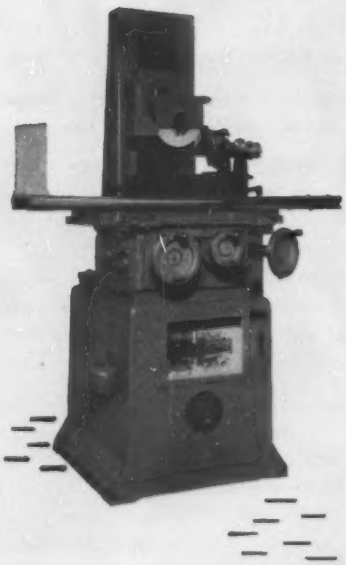
Large stocks are maintained in the following distribution centers: Hartford, New York, Philadelphia, Baltimore, Elmira, Detroit, Dayton, Chicago, St. Louis, Minneapolis, Los Angeles, San Francisco.

Immediate Stock Delivery

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

PLAN NOW FOR REPLACEMENT

with REID GRINDERS



It's strictly a dollars and sense proposition. The cost of a new surface grinder is not high in relation to the benefits that accrue from more accuracy, better quality finishes and ease of operation.

And it certainly makes sense, in today's competitive business world to replace older type grinders that invite work-spoilage and rejection.

If you're still using over-age surface grinders, it will be good "insurance" to talk with your Reid dealer today.

He'll show you why modern Reid Grinders will increase efficiency in your toolroom.

see our catalog in MACHINE TOOL CATALOGS or write for copy.

For the full story on Reid Surface Grinders, please write for Bulletin 618-1

PRECISION REID SURFACE GRINDERS

steel sheets, (AM—Feb 1 '54, p177), and publish them in book form. The use to which such unusual things are put should also be included.

However, unusual happenings on bedsheets is another story (AM—Mar 15 '54, p177) and should not be made public. To use them for designing purposes is as ridiculous as trying to use a milling machine for a toothpick. I will agree, notwithstanding, that many a good idea has been created on a bedsheet.

John Homewood
Burbank, Calif

Head Work

This discussion about the inaccuracy of instruction manuals (*AM* — May 10 '54, p98, and June 7 '54, p109) strikes me as being rather stupid. Evidently none of the writers of these letters has the slightest idea of how much it costs to prepare and print such manuals. I do, because I have just finished writing a little four-page job on how to operate and maintain a small piece of equipment. Simple as it is, there are several variations than can occur, and it is no small matter to cover these without a lot of "buts" and "on the other hands." Also, the shop sometimes makes minor changes that I don't even know about, such as changing the position of an oil hole for greater convenience in machining. On top of this, there is always the possibility of making errors in writing—you even make them yourselves occasionally in AM.

I am not condoning errors, but I am sure that machine tool builders do make every effort to have their manuals correct, if only for their own protection, and I have no doubt they expect the users to apply a modicum of common sense in reading them. If there is something that does not quite jibe, it is a simple matter to write or call the builder for more particular information. I'll admit that the example quoted by Mr. Wilson, of the cross-slide that was supposed to be pressure-lubricated but was not, might have been a source of trouble, but anyone responsible for lubrication of the machine could see with half an eye whether it was pressure-lubricated

or not. Let's use our heads a little in matters of this kind.

H Kenworthy
Buffalo

Snows of Yesteryear

What has become of the old-timer who used to be a feature of almost every machine shop? I remember him so well from my own apprentice days. He was an all-around mechanic, at home with any machine tool in the shop, skilled in benchwork, and never fazed by any job that came along. Tools seemed just naturally to fit into his hands, his chisels were never mushroomed, his calipers and scales were always clean and lightly oiled.

I remember one, in particular, who steered me over many of the shoals of my younger days. He must have been in his mid-fifties, although he seemed very old to me. His tool chest was a thing of wonder. Inside its lid was a picture of Mount Fuji, a souvenir of his three months in Japan, and it contained many tools that I have never seen before or since but which he had made himself to suit some of his unconven-

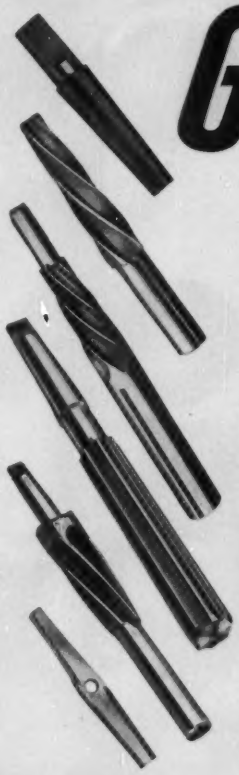
tional methods. Often he would do a job and tell me, "I learned this from a guy in France,"—or Russia, or Germany, or Argentina, or some other far-away place — "but don't you try to do it this way. You learn to do it the proper way." Then he would show me the correct procedure.

I owe much to Old George. Yet he was not unique. His counterpart could be found in many shops, and he must be remembered by many men of my generation. But where are his successors? Old George is dead this many a year. But why is there no one to take his place? Did all of our generation prefer to stay at home, to remain in the rut of convention? Are the frontiers closed? Are the dusty covers locked forever on the bright pages of adventure? Or is this just the nostalgia of an old man remembering Spring in the darkening days of Winter?

Wm Herndon
Miami

FOR SPECIAL REAMERS . . . REMEMBER

GORHAM



They may not *look* alike, but all of the special tools on this page share a common function . . . *because every one is a reamer!* Each was engineered and manufactured by Gorham Tool Company to provide a practical solution to a specific production machining problem for one of our customers.

Actually, these reamers represent just a few of the many special-purpose cutting tools produced by Gorham. Others include milling cutters and end mills, inserted blade cutters, flat and circular form tools, profile cutters, and carbide tipped tools of every description. Gorham "specials" are turning problems into profits in thousands of plants every day . . . and the one we engineer for you will solve *your* next production machining problem, too! Take advantage of our experience.

Your nearby Gorham Field Engineer is a qualified cutting tool expert in both practical design and actual application, and his assistance is yours without obligation. Just write for his name, or send details of your problem direct to us. We'll have him get in touch with you promptly.

Gorham TOOL COMPANY

"EVERYTHING IN STANDARD AND SPECIAL CUTTING TOOLS"

14408 WOODROW WILSON • DETROIT 3, MICHIGAN

WEST COAST WAREHOUSE: 576 North Prairie Ave., Hawthorne, Calif.

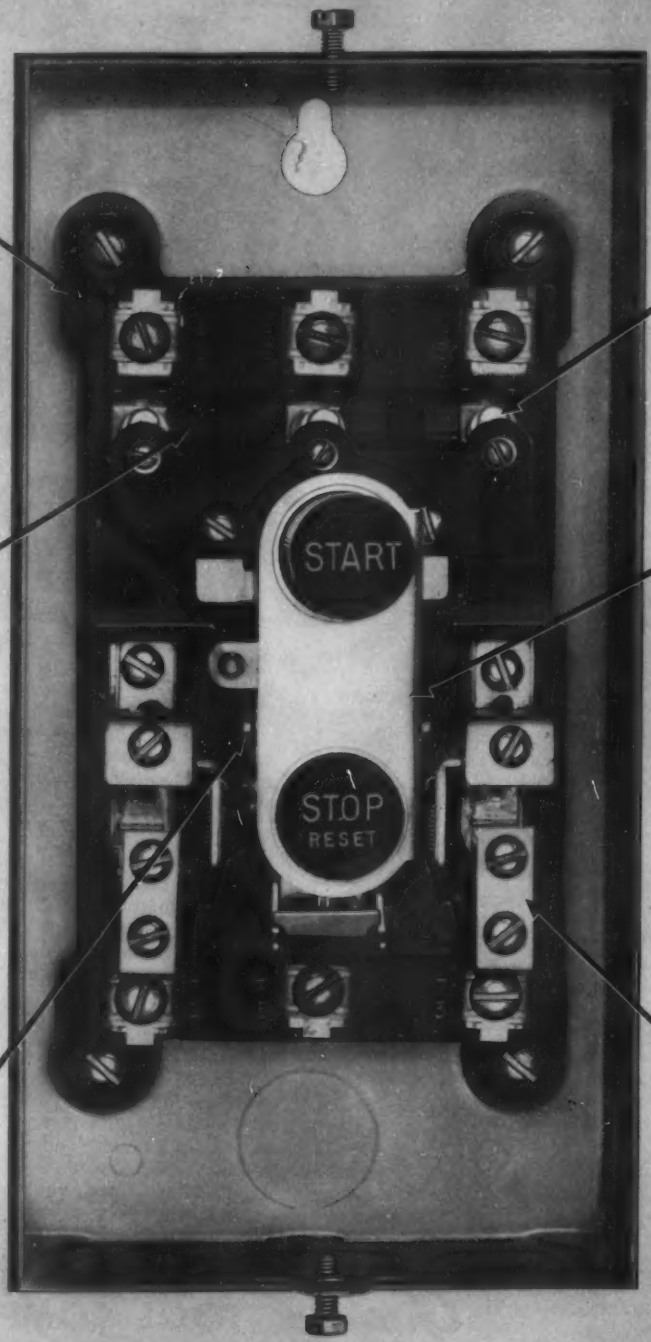
6 Reasons Why . . .

G-E MANUAL STARTERS GIVE MAXIMUM

INSULATED BASE. The starter's molded insulated base provides maximum protection from grounding. Barriers to isolate contacts and reduce arcing are made from hot molded material which doesn't absorb moisture. They have sufficient protection against arc-overs, and also act as mounting supports for the switch.

ARC PROTECTION. Arcs are completely confined, even with maximum horsepower and stalled rotor current, in deep insulated wells. This feature provides a high safety factor by reducing the possibility of arc-over between adjacent contacts and results in increased contact life.

SAFE FROM VIBRATION. The snap-action switch mechanism is built so it cannot accidentally trip from machine vibration. Both push button and lever types help protect against inadvertent operation. Guard on toggle-type switch cover prevents accidental tripping, yet is large enough for operation by a gloved finger. The handle guard provides a means for padlocking switch in either ON or OFF position. For fractional horsepower motor switches, a new handle guard incorporating these safety features is available.



ILLUSTRATED STARTER IS ACTUAL SIZE

SPLIT-SECOND BREAK. Operating mechanism is spring-loaded for split-second breaks which reduce possible arcing and contact freezing. Made of fine silver, contacts give years of make and break operations. Large contact surface assures positive contact on make.

TRIP-FREE MECHANISM. On G-E manual starters, the operating mechanism trips free on overload, opening the contacts. This action makes it impossible for the switch to be held closed under injurious overload conditions. Visual indication is given by the lever or push button in the neutral position.

NO INJURIOUS OVERLOADS. Bi-metallic overload relays allow your motor to deliver maximum power without premature tripping, yet help protect against overloads and stalled rotor conditions. This positive protection helps prevent damage to the motor due to heating. Bi-metallic overload relays, unlike the solder-pot type, can be mounted in any position. Easily installed heaters are available in all ratings.

PROTECTION

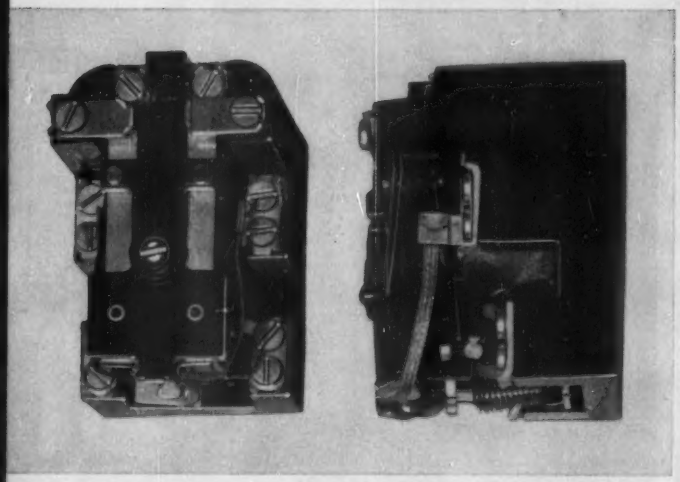
Maximum protection, inside and out, is provided by G-E manual starters. In addition to the features illustrated at left, protective devices have been built into the enclosure itself. Provision has been made for padlocking starter cover (toggle types may also be padlocked in ON or OFF position) to help protect personnel.

ADDITIONAL FEATURES of G-E manual starters include front-connected, clamp-type terminals; straight-thru wiring; general purpose, water-tight, dust-tight and explosion-proof enclosures; clearly marked line and load terminals; and operating mechanisms that are replaceable as units.

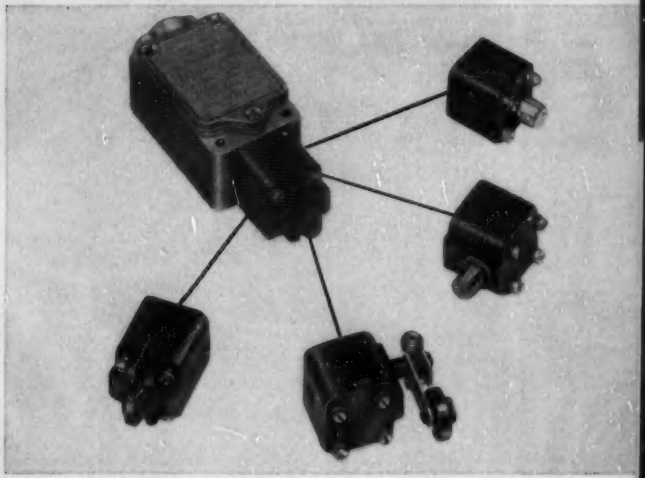
FOR MORE INFORMATION contact your nearest G-E Sales Office, or Distributor, or write Section 730-54, General Electric Company, Schenectady 5, N. Y. Ask for Bulletin GEA-1522.

EASILY ACCESSIBLE MOUNTING KNOCKOUTS in top, sides, bottom and back of case simplify installation. Knockouts are punched for ½ or ¾ inch conduits. Straight-thru wiring, adequate wiring space and saddle-type clamping terminals make wiring easy.

DEPENDABLE RELAYS, LIMIT SWITCHES FOR VARIED APPLICATIONS

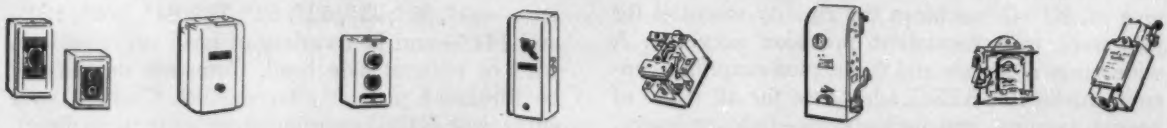


Small size, general-purpose relays are high current rated. Both a-c and d-c forms are available in ratings up to 300 volts. The new, strong, long-life shunt assures dependable relay performance.



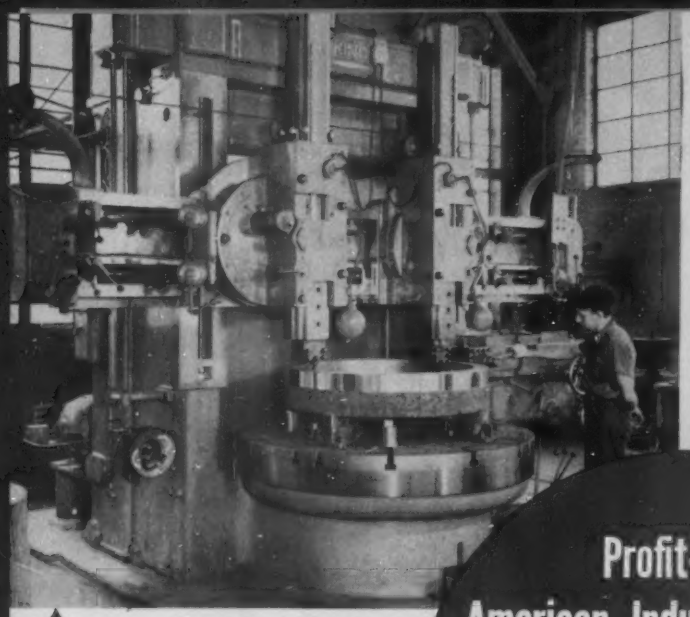
Compact, track-type limit switch has four interchangeable heads: roller lever, side pushrod, top pushrod, and roller pushrod. Heads mount in any of four 90-degree operating positions.

CHOOSE FROM THE COMPLETE GENERAL-PURPOSE CONTROL LINE



MANUAL STARTERS — MAGNETIC STARTERS — PUSH BUTTONS — COMBINATION STARTERS — RELAYS — REDUCED VOLTAGE STARTERS — SOLENOIDS — LIMIT SWITCHES

GENERAL ELECTRIC



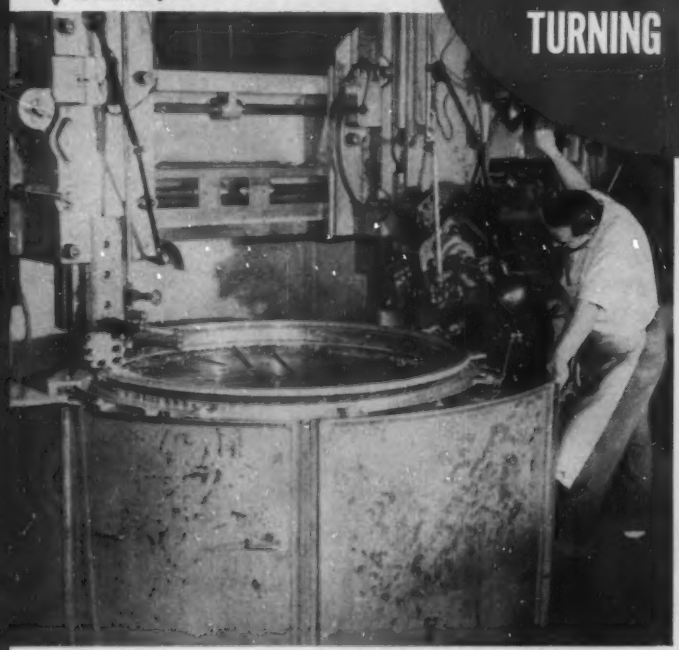
Profit-Wise American Industry Chooses KING VERTICAL BORING & TURNING MACHINES

▲ Operator of 72″ KING at The Tool Steel Gear & Pinion Co., Cincinnati, says "It's the most solid, smoothest-running machine I've ever operated!"

▲ 72″ KING at Combustion Engineering-Superheater, Inc., Chattanooga, "produces more work than the former output of two other mills combined."

▼ 72″ KING at the Kaydon Engineering Corp., Muskegon, Michigan, "consistently produces large diameter, thin section bearing rings with a maximum eccentricity of .001″.

▼ 120″ KING at The Akron Standard Mold Co., Akron, "turns out work even faster than we anticipated . . . has increased production on large size tire molds by 25%."



Massive proportions and extra-heavy construction give all KING machines the rigidity essential for fast work with consistent precision accuracy. A wide range of speeds and feeds, plus simplified controls, make the KING adaptable for all types of boring, turning, and facing work—light or heavy, large or small. KING machines are made in ten sizes—30″, 36″, 42″, 52″, 62″, 72″, 84″, 100″, 120″, and 144″—and in a variety of head combinations, with or without side head. Complete details will be furnished promptly on request. Contact your authorized KING distributor, or write to us direct.

AMERICAN STEEL FOUNDRIES

KING MACHINE TOOL DIVISION

Vertical boring & turning machines . . . 1150 TENNESSEE AVE., CINCINNATI 29, OHIO

Spot News of Metalworking . . .

- **PLASTIC PARTS WITH METALWORKING EQUIPMENT . . .**
  B F Goodrich Chemical Co has come up with a method in which conventional metal-stamping equipment can be used for rapid forming of rigid vinyl plastic products (Examples: pipe, road signs). Rapid conveyor belt carries pre-heated plastic sheet through a standard stamping press. No finishing needed. Vinyl sheeting up to ¼-in. thick can be handled.

- **V-8 TOOLING . . .**
  Machine tools and other production equipment for a new V-8 engine production line are to be bought soon by an important automobile company. Total outlay including tooling: $40-50 million. Engine is for '56 models.

- **KIND WORDS FOR MECHANICAL FEEDS . . .**
  Kind words are being said about mechanical feeds on machine tools. One authority feels that positive uniform feed is essential in keeping the cutting edge on tools as long as possible.

- **LO, THE POOR PEDESTRIAN . . .**
  Passenger cars may have a top speed of 150 mph within five years. Car makers aren't far behind Indianapolis Speedway records: and one of the Speedway cars ran 175 mph at Chrysler's new proving ground's test track.

- **VANISHING ALLOWANCES . . .**
  Allowances for stock on forgings and castings are approaching the vanishing point because of new processing techniques. Current thinking of production men: "What you don't put on you don't have to take off."

- **AUSTRALIAN EXPORTS TO US . . .**
  Growing domestic demand in Australia for Australian-made pipe and tube, now exported in large quantities to the US West Coast, may lead to a ban on exports to the US and elsewhere until home demands can be satisfied.

- **SHORT CUT TO STEEL . . .**
  Heat-treatment process for 60% iron pellets or fine concentrates produced by beneficiating taconite or jasper (low-grade iron ores) permits direct steel production in an electric furnace or possibly in a revised open hearth — by-passing the blast furnace completely. Process, under development by Pittsburgh Lectromelt, supposedly originated at Lincoln Electric.

- **SWEDISH PLASTIC SPORTS CAR . . .**
  Volvo Automobile of Sweden has introduced a plastic-body sports car with these features: top speed of 95 mph, welded pipe chassis, plastic frame seats, foam rubber upholstery, blow-out-proof tires, floor-mounted gear-shift bent a la Mercedes 300 SL. Market aim: South America.

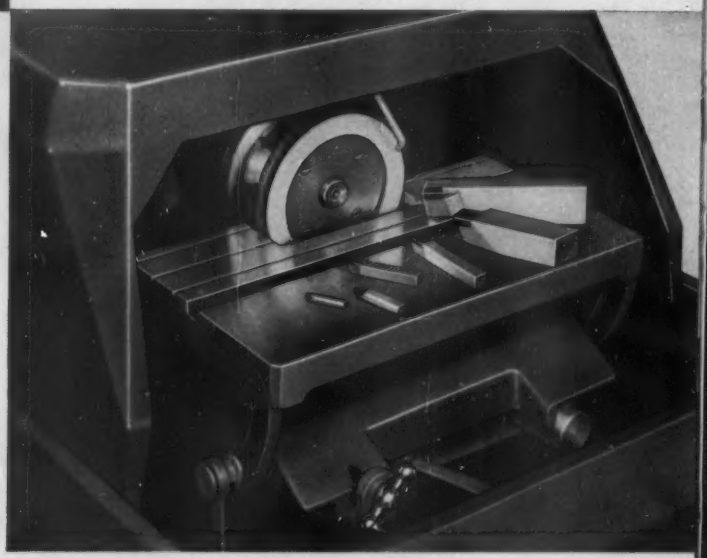
- **DENTAL DRILL FOR DIEMAKERS . . .**
  Developed by the National Bureau of Standards, a 61,000-rpm, hydraulic-turbine dental handpiece is applicable to fine grinding in tool and die-making. Very low cutting pressure is required, and hard materials can be cut with a minimum of vibration and heating.

EVERYTHING YOU WANT IN A Tool Grinder

XLO
EX-CELL-O for PRECISION

A CHOICE OF MODELS FOR EFFICIENT CONDITIONING OF SINGLE-POINT TOOLS

Ex-Cell-O builds a complete line of tool grinders for the precision sharpening of carbide tools, and for a wide range of tool sizes from the smallest precision boring tools to large lathe and planer tools. All Ex-Cell-O Tool Grinders are double-end models with generously proportioned tool rest tables, and all are equipped for face grinding on steel-back wheels. These wheels are advantageous because the straight face gives correct tool angles without curves, and the surface speed remains constant throughout the life of the wheel. For fine finishing of small tools or for fast metal removal on large tools, there's an Ex-Cell-O Grinder to suit the needs of every shop, large or small.



For complete information on Ex-Cell-O Tool Grinders, contact your local Ex-Cell-O representative or send for Bulletin 46337.

Tables are of ample size to give good support to the range of tools for which the grinder is designed. In addition, tables are easily adjustable to the required angles, and are also adjustable toward the wheels to compensate for wheel wear. Slots are machined the full width of the tables to guide tool protractors and wheel dressers.

EX-CELL-O CORPORATION DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

53-45

Washington . . .

A downturn in industry spending for new plant and equipment is indicated for the rest of the year in the government's latest survey. But the government's top economist thinks the figures may be wrong. Dr Arthur Burns, chairman of the President's Council of Economic Advisors, questioned Commerce Department findings, reporting business intentions to invest for the rest of the year.

These charted a $1.3-billion dip for 1954 compared to last year, based mostly on a sharp decline by manufacturers. Burns expressed doubt about this figure at his first press conference since joining the administration a year and a half ago. A special survey he had made for the council showed some manufacturers have recently begun to increase their investment plans. He also cited the latest McGraw-Hill survey as supporting his own feeling that investment this year may well climb up to last year's record high.

• • •

Easy money conditions — with a tendency toward cheaper money and hotter competition among lenders — will continue. That's the meaning of the Federal Reserve's order reducing reserve requirements for banks — a move allowing building up of some $8.5 billion worth of additional credit. That's within a billion or so of what the Treasury will need to meet the deficit over the next six months.

The decision, which will keep US Treasury requirements from tightening up the money market, means continued pressure on interest rates — in the direction of 4% mortgage money, for example, and maybe a drop in the prime lending rate.

• • •

Washington observers think the administration would seek standby power to freeze prices and wages if the Indo-China crisis becomes bad enough to justify a new military build-up of at least $5 billion. But considering Secretary Dulles' loose criteria for US intervention — Vietnam-French cooperation, etc — it now seems unlikely that Indo-China will breed big new money requests for defense this year.

Assuming US intervention in Indo-China, however, when would government controls on prices, wages, and materials be applied? Most officials feel that under current business levels, the economy could absorb up to $10 billion of new defense spending without much inflationary pressure on prices and supplies. But this estimate makes no allowance for the substantial demand that would spring from non-military sources right after the declaration of any emergency — civilian scare buying, hoarding, etc. So Washington leaders shy away from any formula involving new defense spending figures, as a gage to when controls would be needed and to what degree.

• • •

Though the administration has done considerable price-wage control planning and there's been much speculation that Eisenhower would seek standby freeze powers because of Indo-China, it's not certain that the freeze authority would be immediately used in event of US intervention. Decision to invoke ceilings would depend on the level of the economy when the conflict began, the conflict's extent and chances for spreading, etc.

Some experts argue that a little inflation is needed to fight a war, especially if it comes right after a leveling of business activity. They say prices should seek their own levels, that such a policy would widen the mobilization base by bringing in marginal producers.

Other experts demand an immediate 90-day freeze right off the bat. No matter what kind of conflict — limited or global — there would be pressure on prices, they say. Clamping the lid on prices and wages for a short time would give the administration time to figure out how tough or soft longer-range controls should be, according to this view.

The quick-freeze advocates emphasize that action should be across the board, not for selected industries alone. As a horrible example of what shouldn't be done the next time, they point to what happened right after Korea: OPS quickly froze prices on cars, but not on metals.

Actually, the administration isn't committed to emergency price controls at all. The Eisenhower planners would like to be able to handle any war or defense inflation with indirect means — credit and fiscal measures.

• • •

Congressional action is pending on the administration's Customs Simplification Bill, which would help foreign firms sell in the US. Most important provision in the bill: authority for a two-year tariff commission study of the complex jungle of US tariff rates. Objective would be to simplify the duty structure by consolidating rates. Many products are dutiable at a number of different rates depending on the whim of the customs inspector.

• • •

The multi-billion dollar guided missiles program is in for a thorough revamping (see p162). Congress is sour on conflicting Defense Dept reports on the program's operation, production, research, and development, wants it clarified once and for all.

Continuous Operation
High Production
Accurate Flat Surfaces

No time lost in loading and unloading parts on new Model 844 Microflat Machine.

New type multiple-station, self-actuated fixture and more selective controls give this machine a production capacity of a finished part every 3 seconds.

For complete description of this new Microflat Machine write for CROSS-HATCH, Vol. 6, No. 1.

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25TH YEAR OF DEVELOPMENT

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Detroit . . .

Consolidations of smaller auto companies over the past year have had one common aftereffect: each of them has set off a new round of speculation.

The Kaiser-Willys get-together last year stirred up the pot. Rumors were not quieted last spring when American Motors was formed, temporarily taking Nash and Hudson off the list of merger candidates.

Packard's purchase of Studebaker assets is no exception to the pattern. But this latest move, which Paul Hoffman, Studebaker chairman, termed a joining of forces, at least had one different effect: it removed from the automotive glossary the term "independents," a word used rather loosely to identify the six smaller auto makers.

Kaiser Motors and its subsidiary, Willys; American Motors (Nash and Hudson) and Studebaker-Packard Corp. now qualify as the "Little Three," as opposed to the "Big Three" — Ford, GM and Chrysler.

The consolidation of Packard and Studebaker revived the belief that the next negotiations may well involve that new corporation and American Motors.

Hoffman neither confirmed nor denied that such a merger is in the program. (It's well to remember that last winter, he did deny that Studebaker was in negotiations with Packard. Actually, the two companies had been discussing the merger for a year.)

Such a transaction could not be carried out in the near future, since both new corporations need time to effect initial economy moves, integration of manufacturing facilities and so on.

But an eventual wedding of American Motors and Studebaker-Packard may be forthcoming for the very reasons behind the three mergers to date: to get manufacturing costs down to a level competitive with those of the Big Three; to consolidate working capital; to strengthen dealer organizations; to combine design, engineering and research staffs; etc. With Ford and GM scrapping hard for ever larger shares of the market — and succeeding — the "Little Three" are finding that the adage, "in unity there is strength," makes good sense.

Packard's upcoming V-8, for instance, would save AMC the huge expense of tooling for a new engine to go into Nash and/or Hudson.

For the sake of protocol, James Nance, Packard president, and Hoffman, said that the corporation will maintain headquarters in both South Bend and Detroit.

Nance, however, will be the chief operating officer, and eventually, general headquarters for all practical purposes will center around him in Detroit.

First mutual use of the same engines, transmissions and certain body parts should show up on the corporation's 1956 models. It is too late to make mutual use of components in the '55 lines.

Studebaker-Packard has three plants in Detroit, one in Utica, Mich., another in South Bend, and one in each of these cities: Los Angeles, New Brunswick, NJ, Hamilton, Ont, and Mexico City. Combined employment is 24,000. Hoffman suggested that some production and engineering facilities may be closed down later in order to benefit by effecting the economies made possible by the consolidation.

• • •

What price glory? Plenty . . . when it comes to dedicating a proving ground like Chrysler's new 4,000-acre facility at Chelsea, Mich.

The corporation pulled out all the stops for its dedicatory program, bringing about 500 reporters and editors in from all over the country.

Among the expenses: plane and train tickets for many of the reporters; a deluxe special train from Detroit to Chelsea and return; $15,000 to the first four finishers in the Indianapolis "500," who raced their winning cars at Chrysler's high speed track; lavish entertainment; helicopter services; etc.

Cost of the day's program: $250,000.

• • •

In announcing production of its 5-millionth car, Pontiac came up with another statistic which helps to explain today's traffic problems: since the first Pontiac was built in 1926, the total volume of Pontiacs would jam a six-lane highway all the way from Washington, DC, to San Francisco.

• • •

View of one of the "Little Three" engineering departments in regard to gas turbine development: "We know how to build as good a gas turbine as the competition does, even though we don't have a working model. We can't see any point, though, in putting a couple hundred thousand dollars into a working model when the public wouldn't accept a gas turbine in cars for another five years, at least."

• • •

Buick executives thought they'd heard the last of the question: "is it true the wrap-around windshield will crack when the car is jacked up?" But it still crops up in one form or another.

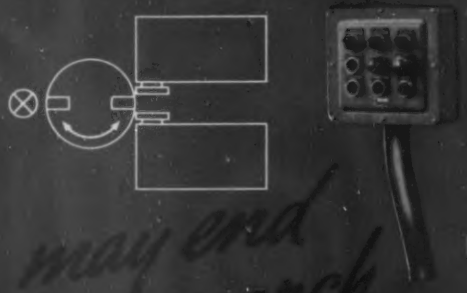
During ceremonies in Flint to commemorate the building by Buick of 2000 Wright J-65 jet engines, a B-57 jet bomber, powered by two J-65s, was flown in and displayed.

Asked one reporter, after circling the speedy night intruder bomber: "Is it true that the wrap-around plastic canopy cracks when you jack up the plane?"

Duplex Milling

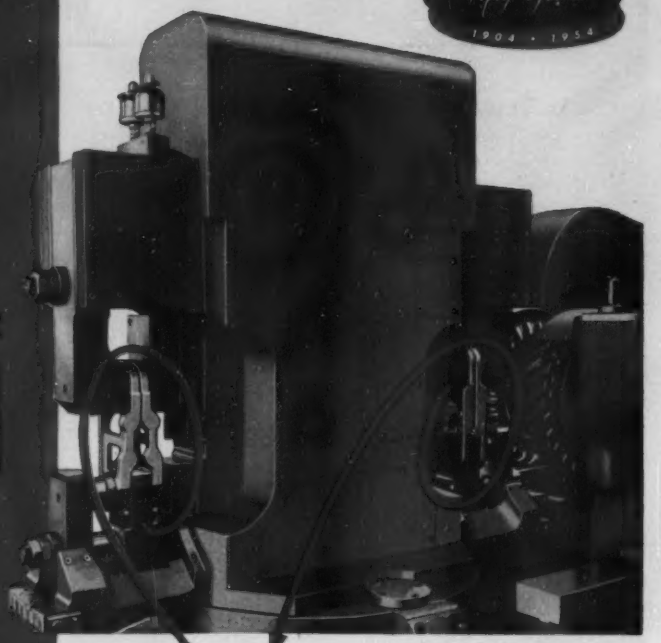
as Engineered by

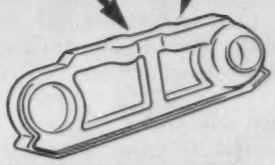
MOTCH & MERRYWEATHER



may end your search

Fifty Years 1904 • 1954

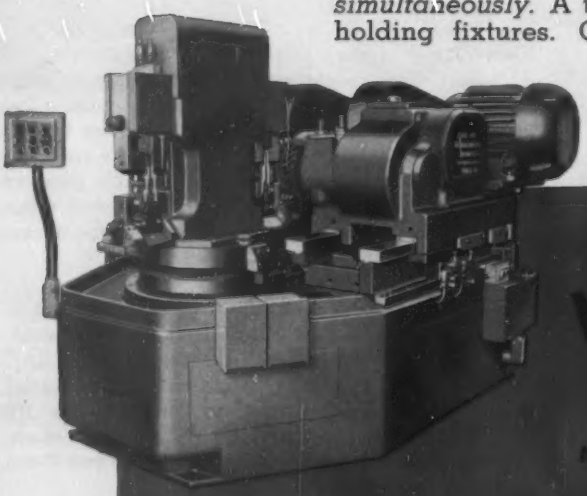




Both sides of tractor side bars are face milled. Production is 240 pieces per hour using high speed steel cutters.

PRODUCTION CAN BE RAISED 50% by Motch & Merryweather's *Duplex Milling Method!*

• Production milling is given new meaning by Motch & Merryweather's duplex method. Two heads mill two parts *simultaneously*. A table indexing 180° has two sets of work-holding fixtures. One operator unloads and loads during *duplex milling* at the opposite fixture. Fully automatic operation sets new production limits. Consult Motch & Merryweather about your production milling.



THE MOTCH & MERRYWEATHER MACHINERY CO.

MACHINERY MANUFACTURING DIVISION

CLEVELAND 13, OHIO

Builders of Circular Sawing Equipment, Production Milling, Turning and Special Machines

Machine Tools . . .

The Armed Services placed machine tool orders estimated at about $40 million in June.

Bulk of the business came from the Navy, and the remainder from the Air Force.

These orders were hastened by the desire of the services to make commitments prior to the end of the government's fiscal year on June 30.

This represents the first important buying by the services in many months. It means that the NMTBA New Orders Index should be up substantially in June compared with May.

• • •

Don't discount too much the automotive industry as a good source of machine tool business in the months ahead. Most of the big retooling programs on engine production are out of the way, to be sure. But not all.

One prominent company is preparing to buy $40-$50 million of production equipment and tooling for a new V-8 engine. The engine will be the first change for this company in many years.

This engine will be built in the Detroit area in an existing building owned by one of the company's subsidiaries. It will be put into 1956 models to be announced late in 1955. Tooling will be for 75-100 engines an hour.

Transfer-type machines, embodying considerable flexibility in their operation, will be included.

Another well-known automobile maker expects to spend a large sum on machine tools for greatly enlarged toolroom facilities.

This company already has toolrooms of impressive size. Even when its capacity has been enlarged, it will continue to purchase a considerable quantity of tools and dies outside.

A sizeable number of presses are a part of the buying program of one automobile manufacturer.

It intends to enlarge its present stamping facilities. What it has in mind is to bring its body capacity up to its engine-making facilities.

Prospects for automotive orders for machine tools do not end with the projects already mentioned.

Companies that recently have spent large sums for new engine lines intend to make substantial outlays for "fill-ins" and for replacements in spots in which big cost-savings can be effected.

It is not possible to estimate accurately exactly how many millions will be spent by the automobile industry for machine tools the remainder of this year, but it will be a healthy total.

• • •

"All too frequently in the past, the machine tool producer has left the design and procurement of automation up to the customer to do the best he can for himself, we are looking to you to assume this responsibility in the future."

Those words were addressed to the machine-tool industry by Harry Rourke, general purchasing agent of the Ford Motor Co, over a year ago.

A check-up of opinions among automotive key men dealing with this subject shows a large measure of satisfaction over the way in which machine tool builders have faced this problem.

Only in a few instances does Detroit believe that builders are dragging their feet.

Automation is occupying the attention of all major automobile companies. It is being applied to new production lines, and existing ones.

One maker, for example, is now automating a body stamping plant. It figures on speeding production and on cutting costs by feeding work into and out of presses mechanically and by moving work automatically from one press to another.

• • •

Chrysler's big party for publication men at its new proving grounds at Chelsea, Mich, supplemented by talks with Chrysler top management, leaves one with the feeling that Chrysler is getting ready to attempt a strong comeback.

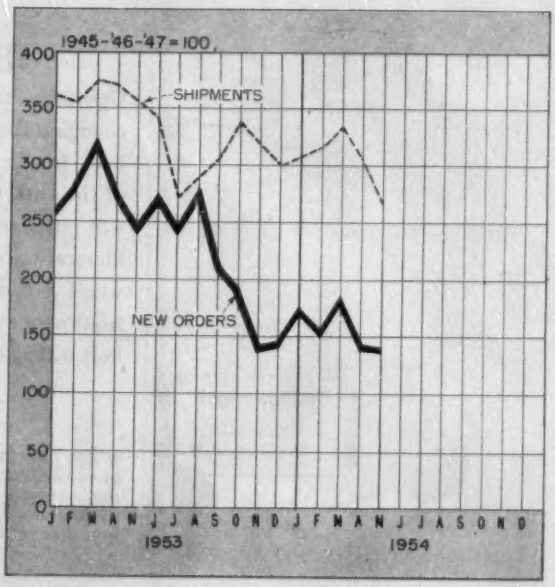
Something akin to a revolution in thinking and planning is obvious in Chrysler. Among other new developments is a program to spend a lot of money in cutting production costs, and that means new machine tools and automation.

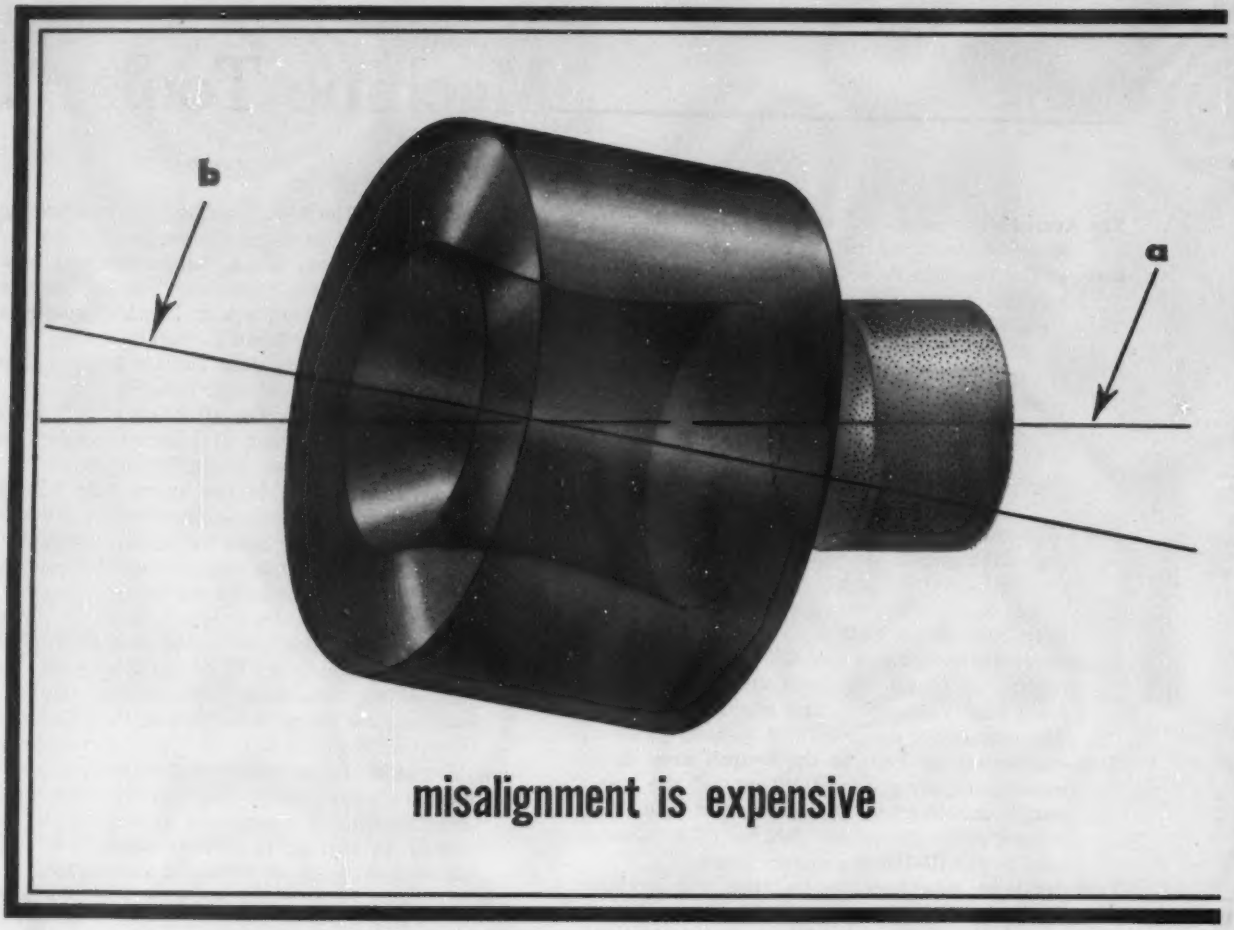
BF

MACHINE TOOL INDEX

(1945-47 = 100)

(Source: National Machine Tool Builders' Assn.)

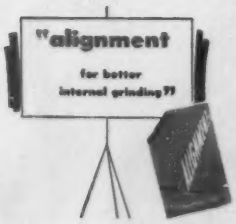




misalignment is expensive

...Bryant controlled alignment

BELL mouth holes are a common internal grinding error. General available information advises simply turning the workhead or changing the length of traverse to correct this error, to generate a straight hole. In the case illustrated above, where bell mouth exists on both ends of the hole, either turning the workhead or changing the length of stroke will improve the shape of the hole but will not correct the error. In the illustration, the work axis "b" is tipped out of alignment with wheel and wheel path axis "a". When the wheel, moving on axis "a", traverses the front of the hole, it grinds above the work center line and the front of the hole will be oversize. As the wheel traverses the center of the hole, the hole



Write for "Alignment" booklet which gives complete details on this interesting subject. Also ask for booking form on new sound, color movie—free showings arranged for engineering groups.

The Bryant 1130 Hydraulic Internal Grinder is a heavy-duty semi-automatic machine designed to handle a wide variety of work with minimum time and effort. The 30″ swing permits grinding of straight and tapered holes in large diameter work to a maximum depth of 12″. The workhead can be swiveled to grind tapers up to 15° included angle. The workslide is mounted on preloaded balls to provide rigid and sensitive control. The left end may be raised or lowered to bring its axis into a plane parallel with the wheel path. Stable three point support is provided under the wheelslide and this, too, may be adjusted to insure straight line motion of the wheel. The Bryant 1130 has an extremely rugged bed to meet the requirements of heavy work. Coolant and hydraulic tanks are separate from the bed. Write for folder.

gives better internal grinding

will be smaller. As the wheel traverses the back of the hole, it grinds below the center line and the hole will again be oversize. While the wheel contact may be a full line, it will not be parallel to the axis of the work.

The only possible remedy is to correct the alignment of the workhead axis "b" so that it will be parallel with the wheel and wheel path axis "a". Wheel wear will be uniform but, most important, the geometry of the hole will be correct.

Bryant internal grinders are engineered to permit adjustment which will bring the workhead into proper alignment.

see our catalog in MACHINE TOOL CATALOGS or write for copy

Bryant Chucking Grinder Co.

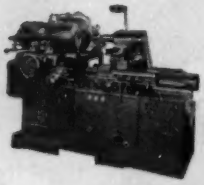
Springfield, Vermont, U. S. A.

Internal Grinders • Boring Machines • Internal & External Thread Gages • Granite Surface Plates

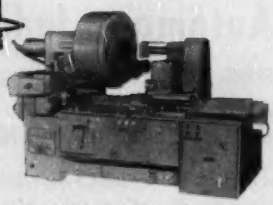
no. 1109 9″ swing, semi-automatic

no. 1309-W 9″ swing, 2 spindle semi-automatic

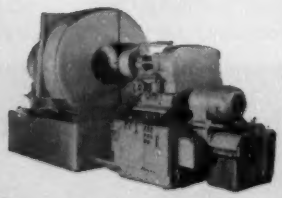
no. 2209 9″ swing, automatic



no. 1116 16″ swing, semi-automatic



no. 1130 30″ swing, semi-automatic

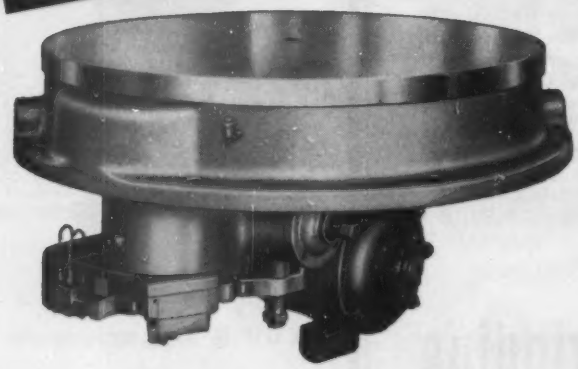


no. 1460 60″ swing, semi-automatic

automatic cam feed units

Avey has both...

automatic index tables



Automatic Index Tables

meet demand for Drilling and Tapping Equipment

Made in sizes 16", 20", 24", 30", 36" and 40" diameter. Indexes, 3 to 100 stations.

These Index Tables are self-contained units, built on unit construction principle and includes motor drive assemblies. All drive and control mechanisms underneath table for free work surface...easy accessibility.

Send for Bulletins

Automatic Cam Feed Units

for Drilling...Tapping...Reaming...
Hollow Milling and Deep Hole Drilling
Vertical, Horizontal or Angular Mounting

Units are universal in application...let us show you their application to your job.

Made in two sizes—No. 1 and No. 2 Morse Taper.

This simple unit gives high production at a lower cost. When used in multiples to complete operations, no relocation of part is necessary, thus producing more accurate work.

Semi-skilled operators will deliver high production accurately and efficiently, yet with a minimum of supervision.

THE AVEY DRILLING MACHINE CO.
Cincinnati 1, Ohio

Avey

Gaging Metalworking . . .

PRODUCTION INDEX
BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	JUNE '54(*)	MAY '54(p)	APR '54(r)	MAY '53
Tot. Index...	**146**	**147**	**146**	**169**
Machinery	**125**	**126**	**146**	
Electrical Machinery	**164**	**163**	**194**	
Autos	**109**	**107**	**130**	
Other Transportation	**296**	**286**	**301**	
Other Metalworking	**122**	**122**	**142**	

(*) Estimated (p) preliminary (r) revised

Metalworking activities promise to sag further this summer. The foremost question now is whether the production curve will turn upward in the early fall.

Operations in the September-December period probably won't do much better than hold their own. The truth is that orders are still dropping month by month.

McGraw-Hill Index of New Orders for Machinery (non-electrical) declined 7 points in May. It stood at 81, compared with 88 in April (1950 100) May 1953's figure was 107.

Defense business comprises a constantly dwindling portion of metalworking output. Nevertheless, its influence upon the whole should not be underestimated.

Wholesale shutdowns of companies for 1-2 weeks of vacations will have an adverse effect on production this summer.

In spite of all this, one shouldn't lose sight of the fact that metalworking over-all is doing very well and still running far above the 1947-49 level.

1954 is turning out to be a profitable year for the majority of metalworking companies.

• • •

Chicago's 30 or 40 union tool and die shops averted a strike recently by giving the unions what they asked. Average hourly rate for Chicago's union tool and diemakers is now upward of $3 — believed to be the highest in the US — about 8-9¢ higher than the previous hourly figure. This is significant in that Chicago shops set the wage pattern for some 400 tool and die shops in the Midwest.

Practically no change is reported in sales of farm machinery in the last two months. Currently sales are running 30% under the comparable period last year.

• • •

The picture is much brighter in the domestic heating plant field, where sales are within 3% of last year's.

Domestic plumbing goods business is looking up after a slow start at the beginning of the year. Current sales are down only 7% from high 1953 sales for the period.

• • •

One Midwestern steelmaker, Inland, reports its current operating rate at more than 100% of capacity.

Inland's top management thinks that steel output will stay at current levels through third quarter 1954, then start a slow climb.

This is in spite of an anticipated steel strike. No significant scare buying because of the expected strike has shown up to date — just a few orders from scattered small customers have been upped because of the anticipated steel strike.

Another steelmaker reports its Chicago mills are operating at around 82.6% of capacity, and expect to hold at this level all through the summer. Then, it is expected, business will pick up slowly.

• • •

Factory sales of TV sets are picking up fast after a slow start early this year.

Now it looks like sales may hit 6-million sets this year if the current sales upswing continues. Last year's total: 6.3 million.

One reason for the sales upswing: public interest in the Army-McCarthy hearings.

Gaging Business . . .

PRICE INDEX

	JUNE '54(*)	MAY '54(p)	APR '54(r)	MAY '53
Total Index	**132.4**	**132.5**	**132.6**	**130.4**
Metalworking Machinery	**141.6**	**141.6**	**138.9**	
Other Machinery exc. Electrical	**137.5**	**137.5**	**134.3**	
Electrical Machinery	**131.2**	**131.7**	**127.6**	
Fabricated Metal Products	**128.8**	**128.9**	**127.6**	

(*) Estimated (p) preliminary (r) revised

US industrial production is on the upswing at last. The index rose in May for the first time since July 1953 with a figure of 125 (1947-1949 = 100), compared with 123 in April.

When you figure the May figure of 125 is only 9% under the all-time highs achieved in last year's twin peak months of May and July, the industrial picture looks pretty healthy.

Top output gains recorded in May were by manufacturing, primary metals, fabricated metal products, electrical machinery, transportation equipment, printing and publishing, food and beverages.

Declines were reported by non-electrical machinery, instruments, petroleum and coal products.

• • •

Construction is expected to hit an all-time high of $36 billion in 1954. Previous high was last year with $35.3 billion. This gives the lie to early estimates that construction would drop off 2% this year.

Main reason for the construction upturn is the unexpectedly high level of new home building so far this year. Indications are that more than 1,050,000 new homes will be started before 1954's end.

• • •

May retail sales were a little lower than April's for a total of $14.3 billion. But they were only 3% under May 1953. Biggest declines were registered in auto and apparel sales.

• • •

Signs of a receding recession: average factory production workweek went up from 39.0 to 39.3 hours in May — the first increase recorded in three months.

And average hourly earnings of factory workers went up to an all-time high of $1.81 in May. This was 1¢ higher than the previous record. Wages this year are 5¢ higher than in '53.

But because of fewer hours worked this May, the weekly paycheck was 50¢ smaller than in May 1953. May pay of $71.13 was the second highest this year — topped only by February.

WEEKLY BUSINESS INDICATORS

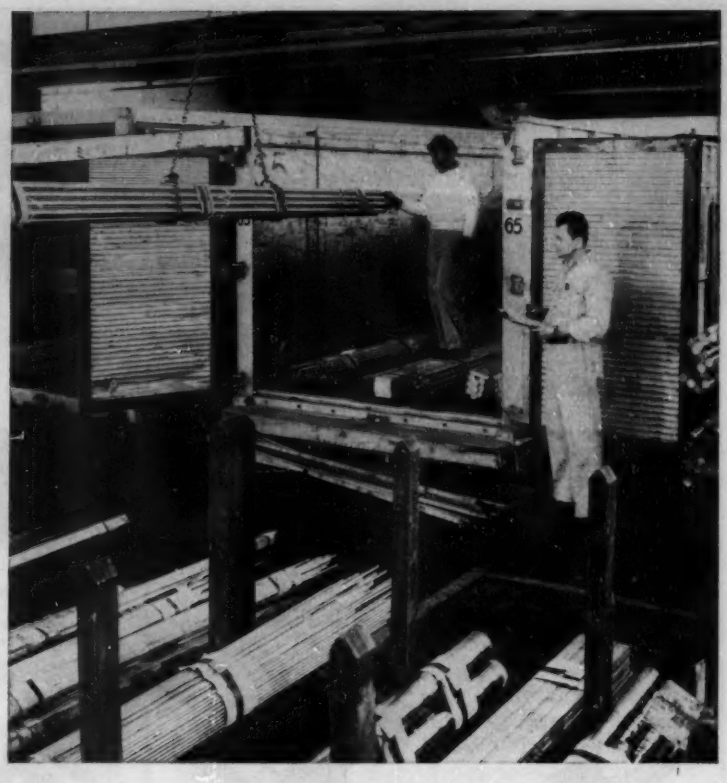
	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-1949 = 100)*	125.8	125.7	136.4
Steel ingot operation (thousands of tons)	1,731	1,725	2,183
Electric power output (million Kilowatt hours)	8,850	8,658	8,329
Production of automobiles and trucks	141,878	139,312	170,357
Engineering construction awards (*Eng. News-Record*—millions)	$312.9	$317.9	$484.4

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Index of industrial production (1947-1949 = 100)*	125	123	137
Index of durable manufactures production (1947-1949 = 100)*	135	134	156
Durable goods manufacturers' sales, millions*	11,484	11,385	11,398
Electrical machinery manufacturers' sales, millions*	1,351	1,355	1,387
Other machinery manufacturers' sales, millions*	1,943	1,941	2,227
Durable goods manufacturers' new orders, millions	10,138	10,206	12,702
Electrical machinery manufacturers' new orders, millions	1,132	948	1,697
General machinery manufacturers' new orders, millions	1,775	1,677	2,184

* Seasonally adjusted.

Why this means quick delivery of ARMCO STAINLESS STEELS



Here are stainless steel bars being loaded at the Armco mill for shipment to an Armco Distributor's warehouse. Nationwide Distributor stocks bring us closer to you. That's why you can obtain Armco Stainless Steels of popular analyses in a selection of sizes, shapes and finishes—often in less than 8 hours after receipt of the order.

Armco Stainless Distributors know their business. All have mill-trained salesmen who can help you with stainless problems. They have the latest Armco literature—available for the asking—on forging, machining, heat treating, pickling and other fabricating operations.

If you need quick delivery of stainless bars or wire, glance over this list of Armco Distributors. A phone call to the nearest one will bring you action.

ARMCO STAINLESS STEEL BAR AND WIRE DISTRIBUTORS

CALIFORNIA
Los Angeles
Ducommun Metal & Supply Co.

San Francisco
Electric Steel Foundry Co.

COLORADO
Denver
Metal Goods Corporation

CONNECTICUT
Hartford
The Am. Steel & Alloys Corp.
Peter A. Frasse & Co., Inc.

GEORGIA
Atlanta
J. M. Tull Metal & Supply Co.

ILLINOIS
Chicago
Central Steel & Wire Co.
Chicago Steel Service Co.

LOUISIANA
New Orleans
Metal Goods Corporation

MAINE
Lewiston—Auburn
Brown-Wales Company

MARYLAND
Baltimore
Seaboard Steel & Iron Corp.

MASSACHUSETTS
Cambridge
Brown-Wales Company
Industrial Steels, Inc.

Fall River
Congdon & Carpenter Co.

MICHIGAN
Detroit
Central Steel & Wire Co.

MISSOURI
North Kansas City
Metal Goods Corporation

St. Louis
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(See Metropolitan New York)

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TEXAS
Dallas
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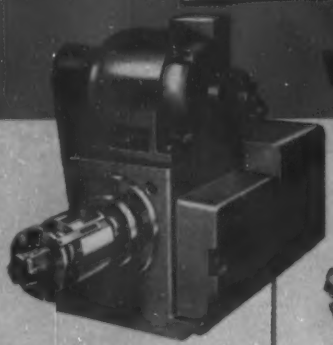
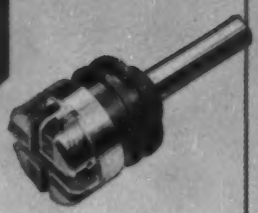


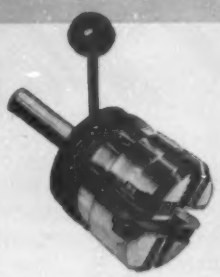
Precision-Pak with die heads and collapsible taps automatically taps holes up to 4" dia., cuts external threads up to 3½" dia.—also bores and reams. Lead accuracy assured by precision lead screw.



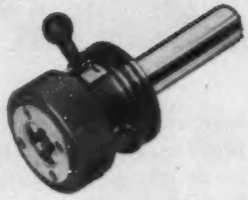
Rotating Die Heads, Type "ORB" with snap action trip and quick change radial type chasers, cut straight threads ⅛" to 5" dia.

Non-rotating Die Heads, Type "OLB" with pull off snap trip and quick change radial type chasers, cut straight threads ⅛" to 5" dia.

Rotating Die Heads, Type "TRB" with snap action trip and quick change Tangent chasers, cut straight threads ⅝" to 2" dia.

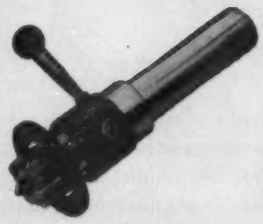


Non-rotating Tangent Die Heads, Type "TLC", with pull-off snap trip and quick change chasers, cut straight threads ⅜" to 2" dia.

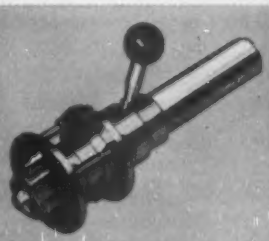


New 4 in 1 Type "ACB" Die Heads, Rotating and Non-Rotating feather action trip, cut straight threads ⅛" to 4" and tapered pipe threads ⅛" to 3½".

Solid Adjustable Taps "EHB" and "RHB" with removable chasers, cut threads 1¼" to 5" dia.—ideal for salvage work.

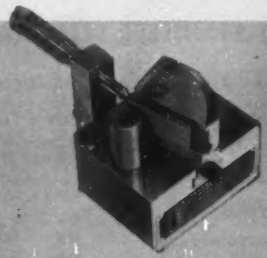


Standard Collapsible Machine Taps, Rotating or Non-Rotating, with easy size adjustment, cut straight threads 1¼" to 7" dia.



Semi-receding Pipe Taps, Rotating or Non-Rotating, with taper receding action, cut 1" to 6" taper pipe threads. May be arranged for straight threads also.

Type "L" Machine Taps, Rotating or Non-Rotating, with 18 interchangeable nose pieces and 2 bodies, cut a range of straight threads to 6¾" dia.



Tangent Chaser Micrometer Setting Fixture provides longer chaser life and better threads through more accuracy in setting chasers in their holding blocks.

Universal Chaser Grinding Fixture for use on either a surface or cutter grinder assures accuracy in grinding chasers of all types.

For more complete information on Sheffield-Murchey threading tools, get in touch with your local representative or write for Catalog MU-153.

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6548

American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

What Are You Doing About Automation?

The uncomfortable suspicion lurks in our mind that the word "automation" is frightening away a lot of people in Metalworking who should know more about it and who should apply it in their own shops.

This state of affairs is understandable. Automation, a new word, first appeared in print only six years ago. Incidentally, American Machinist was the first publication to mention it.

Automation as a term caught on quickly. It had glamour. But before long, it was invested with a new meaning by those who wrote and talked about it. It became synonymous with the automatic factory. It became a catchword for a "catchy" idea.

Those who thought of automation, and immediately visualized an automatic factory, naturally related it to a manufacturing plant in which all humans had been replaced by machines. And the machines took their orders from automatic control devices.

Automation then was associated in the minds of the uninitiated with huge mass production. The man in charge of a medium-size or small plant dismissed automation as something for the automotive boys who turn out cars by the millions, but not for him.

It is right there that the smaller-shop operator makes a big mistake. Automation first was introduced by a giant, the Ford Motor Co. D H Harder, vice president of Ford in charge of manufacturing, coined the word. But Mr Harder did not have in mind the automatic factory when he pioneered in automation. What's more, he still does not have it in mind.

The early definition of automation, and the one to which Mr Harder continues to cling, is merely this: The automatic handling by mechanical means of parts being processed through manufacturing operations.

The first spectacular application of automation was in Ford's use of "iron hands" and other mechanical lifting and turnover devices for steel sheets in its Dearborn stamping plant. Another early use was to transfer hot, heavy coil springs from a coiling machine to a quench tank, a job which was called "mankilling" prior to automation.

Before automation, the human factor set limits on how far and how fast productivity could be increased. Machine tools had to be designed keeping in mind the fastest safe and comfortable speeds at which men could load, operate and unload the machine. Automation permits far better use and design of machine tools. Conveying and loading mechanisms can now be built to serve the full capacity of the machine.

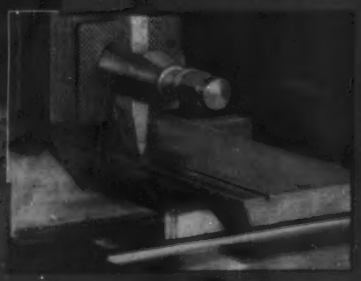
All of this is preliminary to saying that even Ford, with its super-duper production, does not think of automation in terms of an automatic factory. And neither should you. Ford points out that its Cleveland engine plant actually is a far cry from a fully automatic factory in which giant electronic computers would carry the job through from start to finish.

Automation is simply making it possible to increase productivity of one machine, or of a series of machines, or of a production line, by feeding work into the machine and ejecting work from the machine mechanically, and then seeing that the work gets to the next operation automatically.

Its usefulness is not confined to big mass-production plants. It may be just as helpful in increasing efficiency in a smaller shop as in a larger shop. It deserves close study, no matter what the size of your plant.

You may well find that automation is one of the main solutions to your problem of cutting production costs.

Burnham Finney



Automatic duplicating of MANY shapes on a Cincinnati Shaper . . .

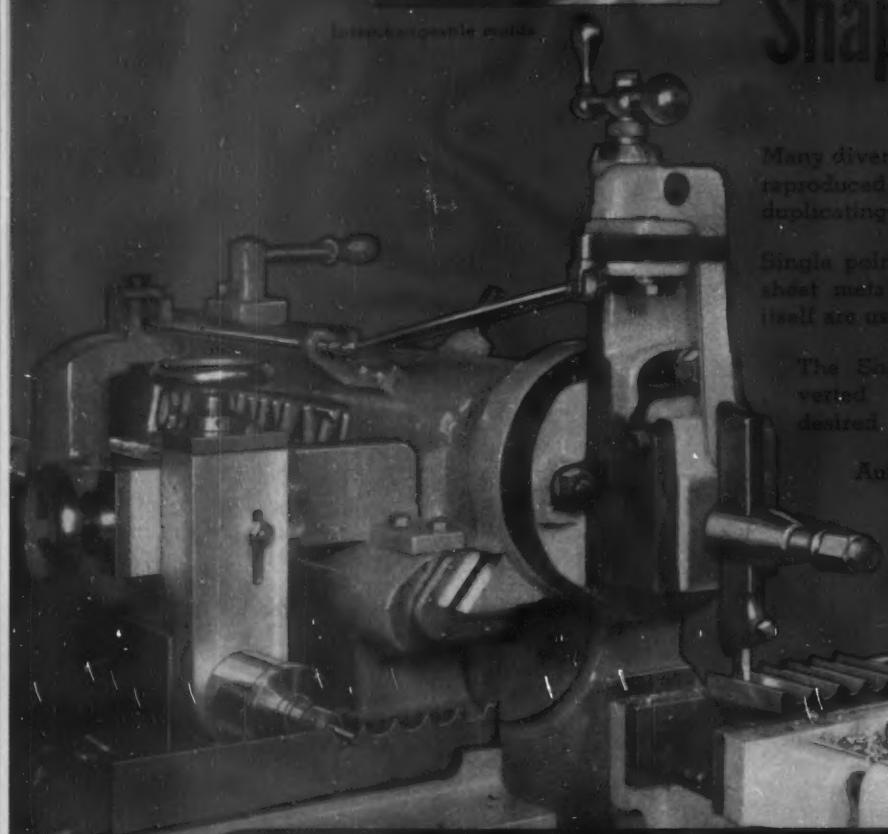
Many diversified parts are accurately reproduced at low costs by automatic duplicating on Cincinnati Shapers.

Single point tools, simple low cost sheet metal templates, or the part itself are used to duplicate the piece.

The Shaper is instantly reconverted to standard use when desired.

Automatic duplicating can save you money and time in your shop.

Write for Bulletin N-6.



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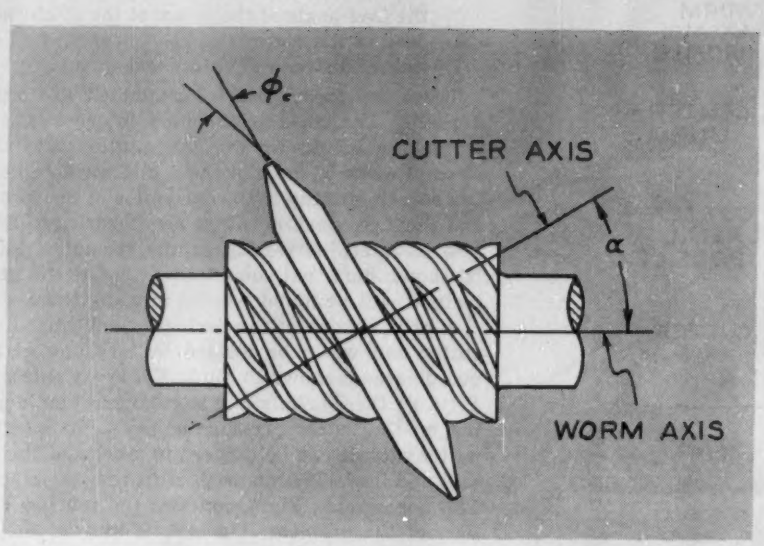


FIG. 1 ... Setup for milling or grinding worm threads

Nomograph aids solution of worm-thread profiles

It's difficult to compute exact worm thread profiles. But you can do it with a nomograph and computation system used successfully for several years by Illinois Tool Works engineers

OLIVER SAARI, development engineer, ILLINOIS TOOL WORKS, CHICAGO 39, ILL

Worms are most often produced by passing a rotating cutter or grinding wheel in relative helical motion across a worm blank, Fig 1. The shape of the cutter or wheel is usually straight in the axial plane, because of the obvious simplicity of maintaining this form accurately. Such "helical generating" with a straight-sided cutting tool results in a worm having curved profiles in both the axial and normal planes, the effect becoming more pronounced at greater lead angles. This effect results because the helicoidal thread has a different lead angle at every radius, hence cannot contact the cutter on its axial plane. The contact is usually on an oblique, curved line, whose shape and position determine the profile obtained on the worm.

Often the exact shape of the worm thread must be known, as, for example, in making a hob to cut the worm gear. A common method of determining this shape has been to make profile measurements on a "dummy" or master worm, and saving the master for the record. This method is subject to undeterminable errors, requires storage space for the bulky masters, and is costly when hobs must be made before the worms themselves are actually in production. The mathematical solution has been found to be more convenient and reliable.

The nature of the mathematical problem to be solved is shown in Fig 2. Given an element or point

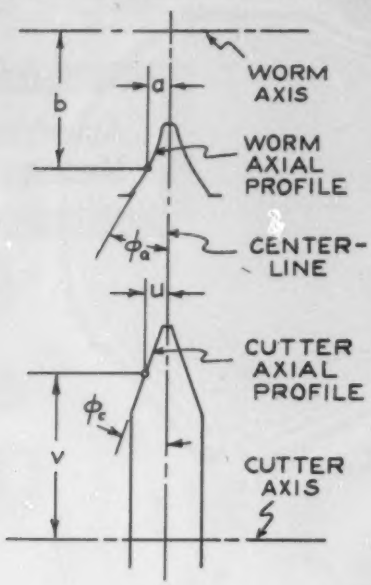


FIG. 2 ... Relationship of worm and cutter profile coordinates

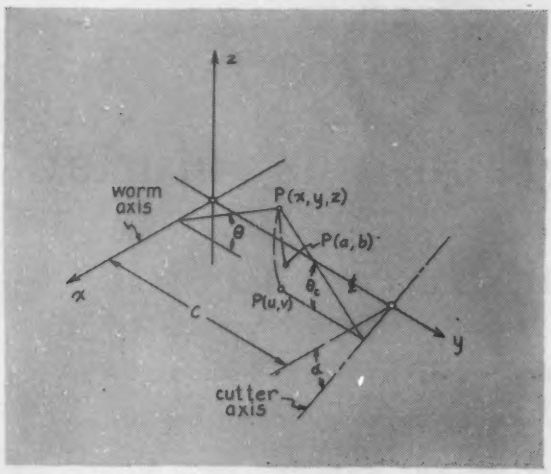


FIG. 3 ... Diagram showing method of solution

of the cutter profile by the rectangular coordinates u and v, measured respectively from the center- or pivot-line (which is the common perpendicular between the axes of the cutter and the work) and from the axis of the cutter, and given the cutter pressure angle ϕ_c at this point, the problem is to find the corresponding point in the axial profile of the worm. This point is located by means of coordinates a and b, measured respectively from the centerline and the axis of the worm. The mathematical formulation must then define a and b as functions of u, v, and ϕ. Where the cutter profile is straight, ϕ_c is of course the same for all the points, but this is not a limitation on the method. The shapes produced by cutters with curved profiles can be computed with the same formulas provided that the proper value of ϕ_c is used for every point.

Symbols used in the formulas are:

u, v, ϕ_c—rectangular coordinates and pressure angle of the cutter as defined above
a, b—axial profile coordinates of worm
α—setting angle of the cutter (usually equal to the lead angle of the worm at the pitch radius)
L—lead of the worm
C—center distance of cutter and worm

These are the quantities on which the solution depends. The other symbols are intermediate ones, whose use breaks up the computation into simple steps. However, some of these intermediate quantities occur naturally in the derivation of the formulas, and their physical meanings are illustrated in Fig 3. The complete derivation of the formulas will not be shown here, but some knowledge of the general method will be found helpful in using them.

A brief outline of the derivation follows: Let the cutter and worm be located in a system of x–y–z coordinates as shown in Fig 3. For every cutter point P (u, v) there is only one angular position, depending on the cutter pressure angle ϕ_c, at which the cutter surface can be tangent to a helix of the given axis and lead. This angle Θ_c must first be solved for. The nomograph, Fig 4, contains the solution to this part of the problem. Once Θ_c is known, the point P (x, y, z) at which the actual finishing contact takes place can be easily found. This point is then projected helically into the axial plane of the worm to complete the solution.

Formulas and method of calculation are:

STEP 1. The form of the cutter and its center distance and setting angle must, of course, be known. Choose a series of points on the axial profile of the cutter for which the computation is to be carried out. Number the points 1, 2, etc., and tabulate to avoid confusion. The table should have space for both the given quantities and the solution, as, for example, Table I. For each point, determine values of u and v, and also ϕ_c if the cutter profile is curved. If the cutter form is symmetrical about the centerline, the resulting worm form is also symmetrical and only one side needs to be computed.

STEP 2. For each point obtain the numbers A and B, where

$$A = \frac{v - u \tan \phi_c}{C - \frac{L \cot \alpha}{2\pi}} \qquad \text{..... (1)}$$

$$B = C \cot \alpha + \frac{L}{2\pi} \left(C - \frac{L \cot \alpha}{2\pi}\right) \cot \phi_c \qquad \text{..... (2)}$$

Note that for a straight-sided cutter, B is the same for all the points and needs to be obtained only once.

STEP 3. From the pairs of values of A and B, read the angles Θ_c for all the points. The angle Θ_c represents the point of tangency of the worm and cutter profiles, and very little error in the computed worm profile results from the inevitable small errors in reading Θ_c from the chart. It has been verified that the nomograph can be read with a practical degree

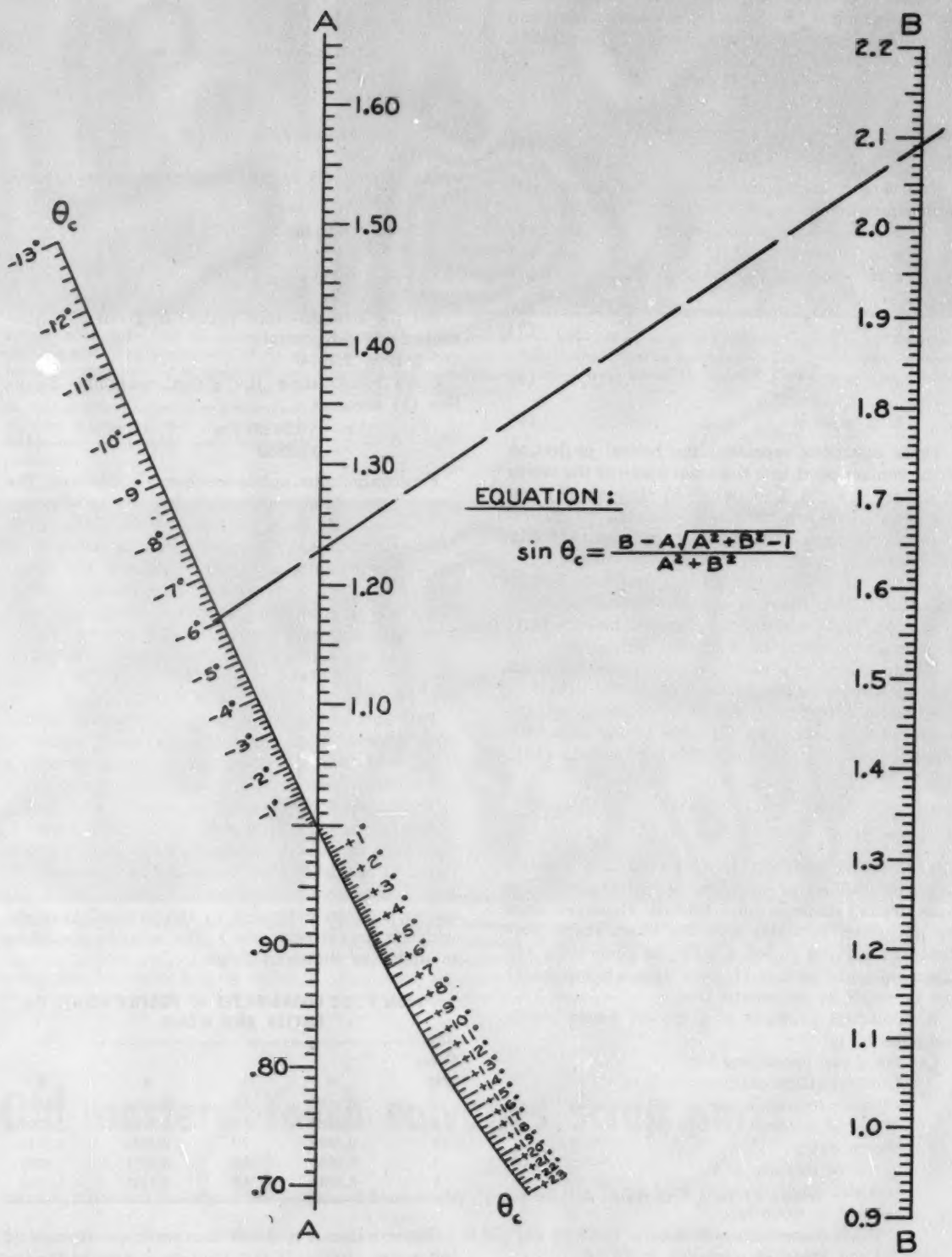


FIG. 4... Nomograph for finding values of Θ_c

of accuracy in all cases. The exact solution on which the nomograph is based, which is not often used and is included here only for completeness, is a solution of the equation

$$A \cos \Theta_c + B \sin \Theta_c = 1$$

where

$$\sin \Theta_c = \frac{B - A\sqrt{A^2 + B^2 - 1}}{A^2 + B^2} \quad \text{..... (3)}$$

STEP 4. For each point compute the worm axial profile coordinates a and b with the following:

$$x = u \cos \alpha + v \sin \alpha \sin \Theta_c \quad \text{..... (4)}$$

$$y = C - \cos \Theta_c \quad \text{..... (5)}$$

$$z = -u \sin \alpha + v \cos \alpha \sin \Theta_c \quad \text{..... (6)}$$

$$\tan \Theta = \frac{z}{y} \quad \text{..... (7)}$$

$$a = x - \frac{L \text{ arc } \Theta}{2\pi} \quad \text{..... (8)}$$

$$b = y \sec \Theta \quad \text{..... (9)}$$

These equations represent the helical projection of the contact point into the axial plane of the worm as shown in Fig 3. Equations (4) through (9) can also be used to find the fillet generated by the tip of the cutter form at the root of the worm threads. The values of u and v in this case are constant, being the coordinates of the cutter form at its outside diameter. Since these equations represent helical projection, the angle θ_c can be varied independently through a series of arbitrary values, and the resulting values of a and b, when plotted, give the generated fillet in the axial plane of the worm.

Sometimes the axial pressure angle ϕ_a of the worm must be found. This is given at any one of the computation points by the following formula (10):

$$\tan \phi_a = \frac{\tan \phi_c \cos \Theta_c \cos \Theta + (\sin \alpha - \cos \alpha \tan \phi_c \sin \Theta_c) \sin \Theta}{\cos \alpha + \sin \alpha \tan \phi_c \sin \Theta_c}$$

The reverse problem, that of obtaining a cutter form for milling or grinding a helical groove of some desired shape, is more difficult. However, since the foregoing formulas give the exact shape produced by a given cutter, a form for generating any given helicoidal surface (for example, a pump rotor) can be found by systematic trial.

A numerical example of a typical worm profile computation is:

Let the given conditions be:

Cutter outside diameter = 6 in.
Cutter pressure angle = 20°
Width of cutter at OD = 0.2832
Worm data:
No. of threads = 4
Axial pitch = 1.500 in.
Lead = 6.000 in.
Pitch diameter = 5.000 in.
Lead angle at pitch dia = 20°54′
Root dia = 3.800 in.

In this case, the cutter is set at the lead angle of the worm at the pitch diameter (although the formulas are general and do not require this condition). Therefore,

$$\alpha = 20°54'$$

$$C = \frac{\text{OD of cutter} + \text{root dia worm}}{2} = 4.900 \text{ in.}$$

$$\phi_c = 20°$$

The expressions $L/2\pi$ and $\left(C - \frac{L \cot \alpha}{2\pi}\right)$ appear repeatedly in the formulas and are constants. In this case,

$$\frac{L}{2\pi} = 0.95493$$

$$C - \frac{L \cot \alpha}{2\pi} = 2.39932$$

For the straight-sided cutter, B, given by Equation (2), is also constant.

$$B = 2.0914$$

Upon substituting the given constants, Equation (1) becomes

$$A = \frac{v - (0.36397)\, u}{2.39932} \quad \text{..... (1a)}$$

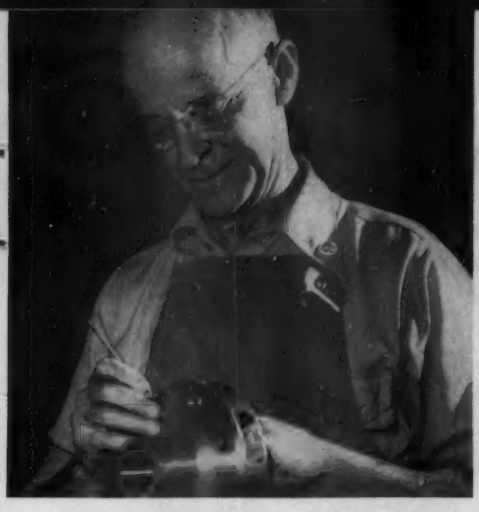
Five computation points are chosen in this case. The u and v coordinates of these points can be obtained by trigonometry from the known dimensions of the cutter. In this case the outer tip of the cutter form has the coordinates $u = 0.1416$ and $v = 3.0$, and is labeled Point No. 1. Equation (1_a) gives $A = 1.2289$. The angle Θ_c is obtained from the nomograph with a straight-edge as shown: $\Theta_c = -6°5'$ approx. Equations (4) through (9) give the a and b values as follows: $x = 0.01887$, $y = 1.91689$, $z = -0.34751$, tan $\Theta = -0.18129$, $a = 0.1901$, $b = 1.9481$.

This part of the computation is repeated for the other points. Note that although small errors in Θ_c as read from the chart cause changes in both a and b, these errors merely cause the computed point to shift tangentially along the exact worm profile, amounting to very little error in the form itself. If the range of A and B values in the nomograph is found to be insufficient, the scales can be extended easily, because they are linear. (Point No. 5 requires such an extension in the present example, which is an extreme case.) The solution should be tabulated as shown in Table I.

***table I* ... COORDINATES OF PROFILE POINTS ON CUTTER AND WORM**

Point No.	u	v	a	b
1	0.1416	3.0	0.1901	1.9481
2	0.2508	2.7	0.2783	2.2108
3	0.3600	2.4	0.3855	2.5018
4	0.4692	2.1	0.5031	2.8097
5	0.5784	1.8	0.6247	3.1258

These values represent the axial coordinates of the worm profile. If this solution is desired for the normal instead of the axial plane, Equations (7), (8), and (9) can be omitted, and suitable equations for helical projection into the normal (or any other) plane should be used.



REPAIR WORK comes from the quality-review crib and production departments. Parts already used and in need of repair are contributed by the service department. Even with the high quality of repair, no extensive checking setup is necessary. Work is checked only by foreman or leadman and Navy spot-checkers

STRIPPED THREADS and crooked holes are corrected by hand and machine work. Stains are removed from parts sent in from assembly floor or finished-stores department. Men above are carrying out an engineering change order calling for blending machining cuts on exhaust-manifold safety-cable links

PRIMARY FUNCTION is "hole-plugging" which calls for drilling holes that have been omitted in production parts, and plugging improperly located holes, later drilled in correct position. Old timer, above, is removing nicks from accessory housing face

REPAIRS AVERAGE between 500 and 600 a week, and many repaired parts are sent right back for assembly. Majority of work is done without aid of fixtures because of variety. As foreman Tom Weatherbee sums it up: "In all the years I've been in quality review, we have lost only one engine because of faulty repairs. In my opinion this is among the most important departments at Pratt & Whitney"

Old masters' touch salvages scrap parts

Here is a bona-fide salvage department that really "pays off." A small group of 45 quality-review repairmen, in the tool room, are doing a big job to keep waste at a minimum by salvaging thousands of aircraft-engine parts each year. Essentially, their job is to correct machining mistakes, and these old timers can boast of a near-perfect record

Titanium is unorthodox

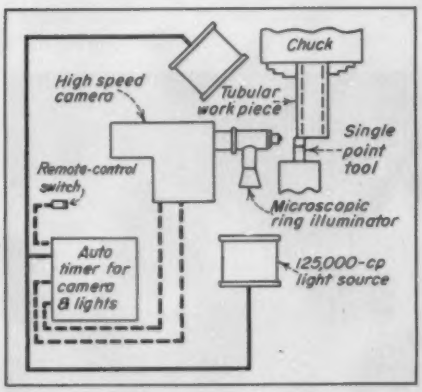
M EUGENE MERCHANT, assistant director of research
E J KRABACHER, senior research engineer
H W YOUNG, research metallurgist
J H MILLER, research engineer
THE CINCINNATI MILLING MACHINE CO, CINCINNATI

Three Key Points About Ti

1. Good surface finish is attributed to the absence of builtup edge, because it is the presence of fragments of the builtup edge on a finished surface which causes it to be rough and appear torn.

2. Low values of forces and power consumption tie in with the high shear angle, because this results in a short path of shear and minimum plastic deformation of metal as it is removed.

3. The peculiar cyclic or irregular chip formation is mainly a result of interference of crystal orientation with the shearing process which forms the chip, as titanium grains, with their hexagonal close-packed crystal structure, have only one easy direction of slip or shear (*AM*, Sept 28 '53, p139).



Here's how data were compiled...

FIG. 1 ... High-speed movies were taken at 7500 frames per sec, through a microscope, of turning on a miller setup. To provide comparison, movies were taken of SAE 1020 and SAE 1112 steel under the same conditions: cutting speed 100 fpm, 0.0063 ipr, sintered carbide tool with 10° and 5° clearance angle. Field size covered by movie frame is only 0.030 x 0.050 in., allowing much more intensive lighting

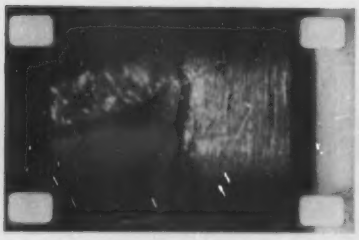


FIG. 2 ... Cutting SAE 1020 steel. Large built-up edge at this speed causes poor surface finish. Low shear angle on tool causes very thick chip, high forces on tool, and requires considerable power to remove a given amount of metal

FIG. 3 ... Cutting free-machining SAE 1112 steel under same conditions. Builtup edge is absent because of lower friction on tool face, resulting in better surface finish

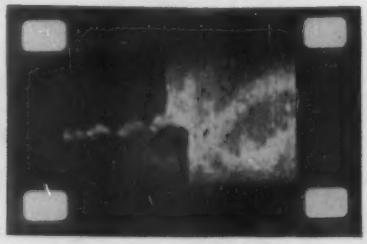


FIG 4 ... Turning titanium Ti 150A. Absence of builtup edge results in excellent surface finish. Shear angle is very high, but not constant in value as when cutting SAE 1020 and 1112 steels. As a result, chip-forming is cyclic. With this high shear angle, and resulting thin chip, tool forces and power consumption are quite low

when machined...Here's why

Better surface finish, lower forces and power consumption but shorter tool life than with steel are titanium-machining characteristics. Ti has a thinner, more-irregular chip and definite shear planes

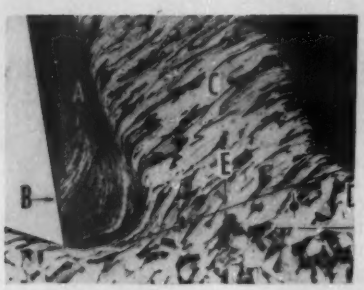


FIG. 5 ... SAE 1020 steel with a large built-up edge *A* along tool face *B*. Shear angle ø, as shown, is small, about 23°, and chip *C* is quite thick compared to size of cut, 0.005 in. *D*. However, note by the uniformly oriented grain structure in chip that the plastic-deformation process on shear plane *E* took place in a relatively smooth and steady manner, without impediment. Chip is essentially uniform in thickness

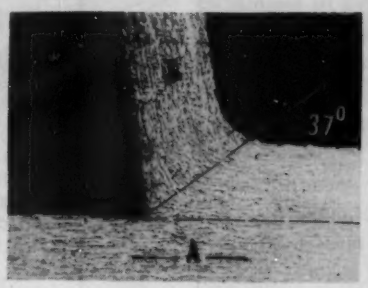


FIG. 6 ... Titanium workpiece (Ti 150A cold-rolled flat stock) shows that cut was made in the direction of rolling *A*. With this particular orientation, chip *B* is just as uniform in thickness as with steel. The chip in this case is much thinner than the one shown in Fig. 5, although size of cut was the same. Difference in chip size is due to higher shear angle of 37°. Absence of builtup edge is characteristic of chip formation with titanium

FIG. 7 ... Titanium, with its hexagonal, close-packed crystal structure, has only one easy direction of shear or slip. Because this shear or slip should have aligned itself with the direction of rolling of the flat stock, the effect of orienting workpiece so that this direction of grain *A* was at about 45° to direction of cut was investigated. Photomicrograph of Ti 150A cold-rolled flat stock shows the result. Shear plane aligned itself with direction of rolling (or of easy slip) so that shear angle also is close to 45°. Chip is quite uniform in thickness, because no impediment to shear exists

Photomicrographic study of chip formation ("quick-stop" technique, *AM* Mar 1)

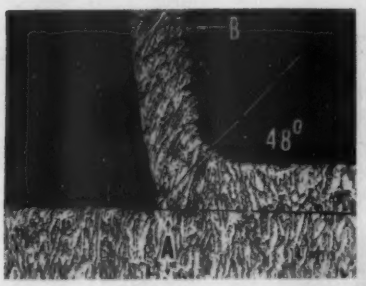


FIG. 8 ... Here the titanium workpiece, Ti 150A cold-rolled flat stock, has the direction of rolling *A* at 90° to the direction of cut. The still larger shear angle of 48° is caused by the shear plane vainly trying to line itself up with easy direction of shear. Instead, the shear plane now must cut across direction of rolling or easy slip, and encounters difficulty. Consequently, shear plane seeks out easiest possible path, concentrates on that momentarily, and then moves on to another easy path. This action produces a cyclic chip formation and a chip of irregular thickness as shown by surface *B*, in contrast to smooth chip surface shown in previous micrographs. Cyclic chip formation can also be seen in movie frames Fig. 4

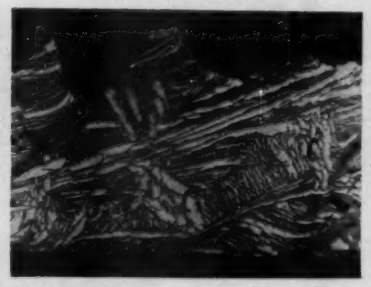


FIG. 9 ... Cross-section through Ti 150A chip. This photo and one in Fig. 10 were taken to determine whether what had been learned about effect of grain orientation on shearing process could be applied to interpreting further the movie record of chips from tubular workpiece. Crystal structure of tubular work was fairly random in nature, instead of being highly oriented. Therefore, shearing process had to seek out paths of easiest shear. This concentrated shearing process in regions where crystals happened to be more or less lined up with preferred direction of shear, as at *A* and *B*. It avoided regions where preferred direction of shear would have had to cut across direction of alignment of crystals, as at *C*. Peaks in photo indicate process of chip formation was cyclic and irregular

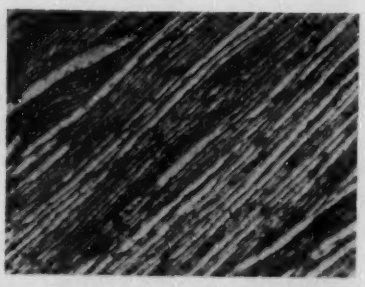


FIG. 10. ... To learn the reason why certain short sections of chip in Fig. 9 were a uniform thickness, as were other chips viewed in motion pictures of turning titanium, a uniform section of this chip was photomicrographed. Note that crystal structure of metal in this region was so oriented that it was practically parallel to preferred direction of shear. This allowed the shearing process to take place ffreely and uniformly because it did not have to seek out properly oriented crystals. With a constant shear angle, a chip of uniform thickness is possible

Force and power requirements

Further studies were made to reveal some of the reasons for poor tool life and to throw more light on force and power requirements.

First step in this phase of the investigation was an examination of the forces involved in machining titanium, as compared to those involved in machining steel. A tool dynamometer was used to measure tangential and normal force components, the third or radial force component being zero in the arrangement used. These measurements made it possible to calculate such quantities as amount of work expended on shear plane in the process of chip formation, friction force between tool and sliding chip, and amount of work expended in overcoming this chip friction. Lastly, measurements were made of average temperature at the chip-tool interface. This was accomplished by making the cutting tool and workpiece two elements of a thermocouple. Further data obtained from the study of the alloying action of titanium supported known evidence that steel-cutting grades of sintered carbide tool material give poorer tool life when machining titanium than do straight cast iron-cutting grades.

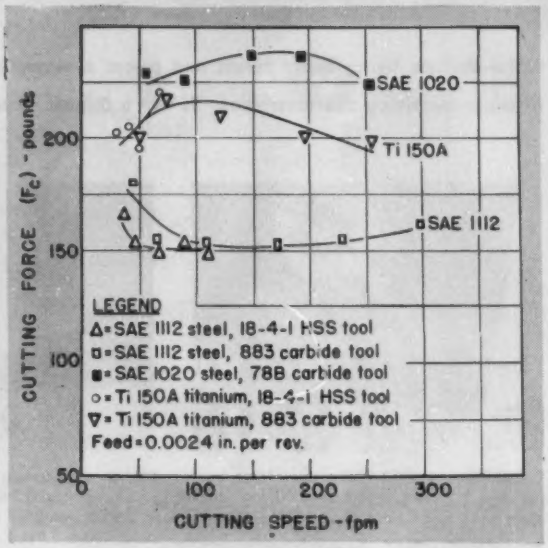

CUTTING FORCE (F_c) - pounds
CUTTING SPEED - fpm
SAE 1020
Ti 150A
SAE 1112
LEGEND
Δ = SAE 1112 steel, 18-4-1 HSS tool
□ = SAE 1112 steel, 883 carbide tool
■ = SAE 1020 steel, 788 carbide tool
○ = Ti 150A titanium, 18-4-1 HSS tool
▽ = Ti 150A titanium, 883 carbide tool
Feed = 0.0024 in. per rev.

FIG. 11 ... Typical values of tangential force component, or cutting force, obtained under conditions indicated in legend. It is the tangential force component which is directly responsible for power consumed in turning. Note that the force involved in turning titanium is less than that required for SAE 1020 steel, although greater than that involved in turning free-machining SAE 1112. Therefore, power consumed or work expended in removing a given amount of titanium metal is intermediate between that required for 1020 and 1112 steels

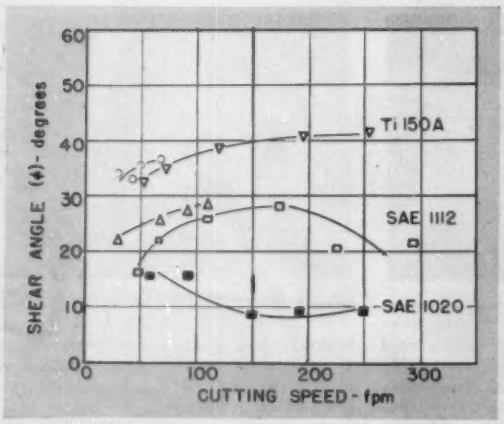


FIG. 12 ... Measurements of shear angle confirm the conclusion that titanium has a much higher shear angle under a cutting tool than 1020 or 1112

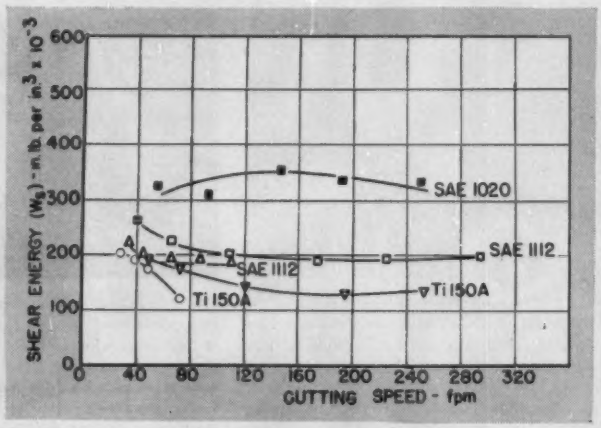


FIG. 13 ... Calculated values of energy expended on the shear plane. Practically all of the energy consumed in shearing process is converted to heat. Therefore, less heat is generated on the shear plane when cutting titanium than when cutting either of the two steels. However, titanium has an unusual combination of thermal properties: low heat conductivity, low density and low specific heat. This combination of thermal properties causes a greater temperature rise for a given amount of heat input at shear plane than is the case with steel. Result: Low shear energy value for titanium, although it means low power consumption, does not mean a correspondingly low chip temperature

Titanium is unorthodox when machined ... *continued*

Friction process between tool and sliding chip

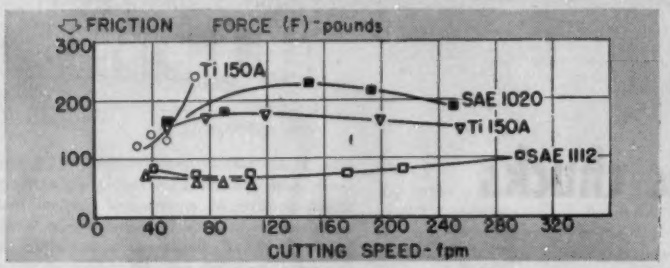


FIG. 14 ... Friction of sliding force of titanium chip on cutting tool is somewhat less than with 1020, but greater than with 1112. It might seem that the energy expended in the friction process when cutting titanium would also be intermediate between that expended when cutting the two steels. However, energy depends not only on force, but also on length of chip sliding over tool face in process of removing a given amount of metal. The fact that shear angle is very high—an important factor in reducing forces and power consumption in the shearing process—is in this case a detriment. This high shear angle means a long, thin chip and, as a result, high values for energy consumed in the friction process

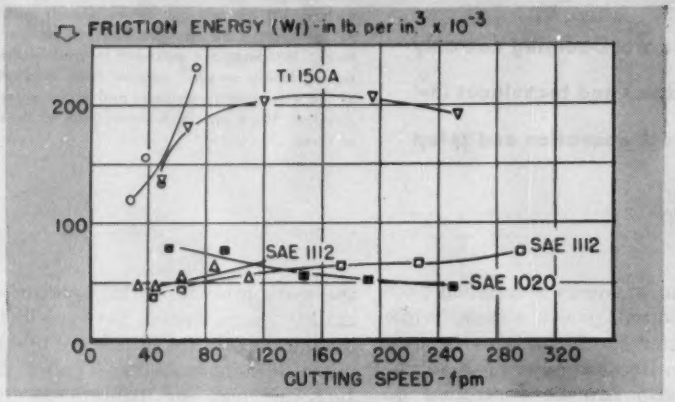


FIG. 15 ... Energy expended in the friction process is higher for titanium than for either 1020 or 1112 steels for the reasons given above. Total energy required in cutting is the sum of energy expended in both shear and friction. Note that the over-all energy for titanium, see cutting force Fig. 1, is intermediate between that for 1020 and 1112 steels. Shear energy for titanium is lowest of the three, whereas friction energy for titanium is the highest, which means a high rate of heat generation at chip-tool interface. Combining this fact with poor thermal properties of titanium, it would seem that temperatures at chip-tool interface when machining titanium would be very high. This is the case

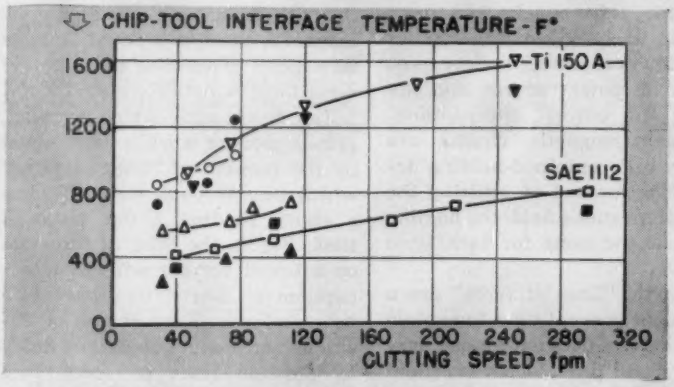


FIG. 16 ... Measured and calculated values of chip-tool interface temperatures. Note the very high temperatures found with titanium. These high temperatures cause the tool to wear and fail rapidly, which is one reason for poor tool life when machining titanium. Studies were also initiated on another factor directly influencing tool wear: the alloy formation which might occur at chip-tool interface. This alloying action was thought to be an important factor because titanium is known to alloy readily with almost any material at elevated temperatures

FIG. 17 ... To study this alloy formation, samples of cutting-tool materials were clamped in contact with titanium, and heated to specific high value of temperature in a vacuum furnace. After heat was maintained for a sufficient lengh of time, sections through the interface were then prepared and examined under the microscope. This photo and the next are typical of results obtained, and show that marked alloying of tool and work material can and does exist. Note the alloy zone formed between Ti 150A titanium (top) and a straight tungsten-carbide, cast-iron-cutting grade of tool material (bottom). After holding at 2000F for 15 hours in a vacuum furnace, the two specimens were bonded together with a well-formed junction

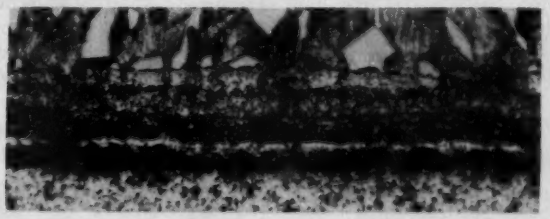


FIG. 18 ... Here a steel-cutting grade of sintered carbide and a button of Ti 150A were clamped in contact, and then heated in a vacuum furnace for 15 hr at 2000F. When examined, alloy zone between the two was found to have quite different properties than was the case with straight tungsten carbide. With this combination, the alloy zone immediately adjacent to the tool material was so brittle that a proper metallographic section through it could not be prepared, because this region flaked away as fast as it was abraded or polished. The flaking away accounts for the very dark zone between Ti 150A (top) and sintered carbide (bottom) and suggests that poor tool wear characteristics of this combination in practice may well be related to this brittleness of the alloy

Know your magnetic chucks

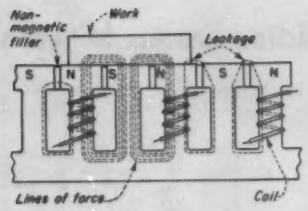


FIG. 1 ... ELECTROMAGNETIC CHUCK and work, with the chuck in the "On" position. Chuck consists of a series of vertical iron cores, with each core wrapped with a winding or coil of insulated wire, which is energized from an external source of direct current. The vertical bar between each magnet provides a return path for the "lines of force." Windings are arranged to produce the same polarity on each magnet core; thus all of the energized cores exert pull in the same direction. Work on chuck shows path of lines of force

Maximum efficiency and safety in magnetic work-holding can only result when you fully understand the principles and techniques involved. Here is a detailed discussion of chuck operation and setup

HENRY GIFFORD, consulting engineer, BRONX, NY

Magnetic chucks once were a novelty; now there is hardly a shop in the country which does not have at least one of these holding devices. In spite of the widespread acceptance of these chucks for grinding, milling, and planing, there are many misconceptions about their operating principles. In the ordinary run of work, this lack of knowledge is seldom a serious drawback, but when setups requiring parallels, raising blocks, and special fixtures must be made, operating know-how will greatly increase the chances for success.

A magnetic chuck consists of a number of parts arranged to produce a series of magnetic circuits. Each circuit provides its own "lines of force" and its own gripping power; each circuit should be used for its own greatest strength, as an entity, in tooling with magnetic holding. In other words, the lines of force are like strands in a cable, with each circuit like the cable, and with the number of cables determined by the strength required to hold the entire part. A shorted line of force is like a broken strand; an interrupted line of force is a dangerously weak strand.

Two general styles of magnetic chucks are in use: the *electromagnetic* chuck and the *permanent-magnet* chuck, with the essential difference between them internal construction. For the former chuck, energy is supplied from an external power source, while the latter chuck contains its own energy. Because power can be varied, grip can be controlled on electromagnetic chucks and more grip can be provided in a smaller area. However, these devices must have a dc power source and are subject to power interruptions. Permanent-magnetic chucks are entirely self-contained holding devices. The method of utilizing the external magnetic field, the holding power, is the same for each style of chuck.

Magnetic "lines of force" are a convenient concept used to explain the action of a magnet. An ordinary rubber band provides an excellent analogy to demonstrate this action. Lines of force possess the properties which provide the "grip"; they have a greater affinity for some materials than for others, and they particularly favor most of the ferrous metals. Affinity is extremely slight for most non-ferrous metals and for non-metallic materials such as plastic, paper, fiber, and air. Materials by which the lines of force are readily conducted are called magnetic and are said to have "high permeability." This condition is shown (Figs. 1 & 2) by the single line leaking through the air and the filler section of the chuck, as compared with the many lines flowing through the section where the work provides a "high-permeability" path. Spaces between the magnet bars in the chuck are filled with low-permeability material such as lead or babbitt. Even though this material is called nonmagnetic, there is a slight leakage through it. The lines of force always form completely closed loops.

The force with which a chuck grips a piece of work is determined by the number of "lines of force" which *pass through the work*. For a chuck holding a flat piece of steel, Fig. 2, the lines of force act on a broad surface without interruptions or shorts; they provide a powerful grip. Work should be positioned on a chuck so that as many as possible lines of force pass through each piece. Some toolmakers place a sheet of tissue paper between the work and the chuck to protect the chuck face. This reduces the number of force-lines and, consequently, the grip. The loss is not serious if the work covers several sections, or magnetic circuits, of the chuck. However, it is better to wipe the chuck and work surfaces clean and place them in direct contact.

Demagnetizing should always be done as soon as possible after a steel piece is removed from a magnetic chuck. Thus, there is less danger of picking up chips and splinters which will spoil setups on the same or other machine-tools.

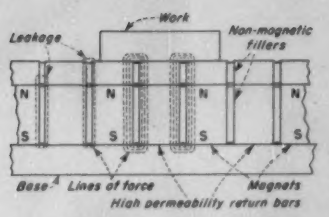


FIG 2 ... PERMANENT-MAGNET CHUCK, using steel bar magnets, in the "On" position. Lines of force pass through the magnets, the chuck face, the work, back through the chuck face, down the high-permeability return bar, and through the base back to the magnet. Thus, they complete a loop or magnetic circuit — and this is essential to efficient holding

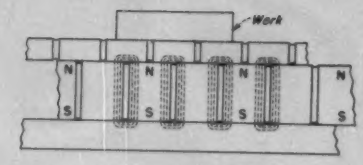


FIG. 3 ... IN THE "OFF" POSITION, caused by rotating a hand lever that shifts the horizontal center section of the chuck (consisting of magnets and fillers) to the right, half of the width of a single magnet, the lines of force are "short circuited." They pass through the chuck face, rather than through the work and the grip is destroyed

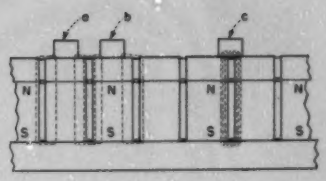
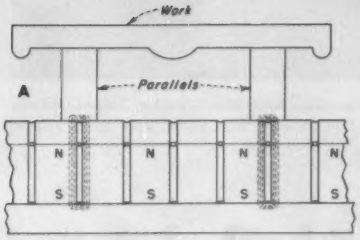
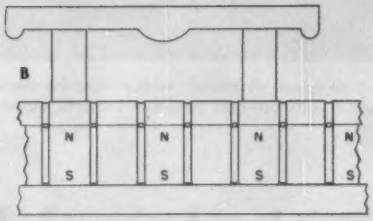


FIG. 4 ... THREE SMALL STEEL PIECES placed on the chuck face create flux paths according to their position. Piece "a" is placed directly on the return bar and piece "b" is placed directly on the magnet bar. In each of these positions, the lines of force must pass through air to form a complete loop. Because their affinity for air is very low, only a few lines are developed and the grip on the work is extremely weak; almost undetectible. Piece "c" bridges the gap from magnet to return bar and the lines of force form a complete circuit in metal. Thus, the work is securely gripped





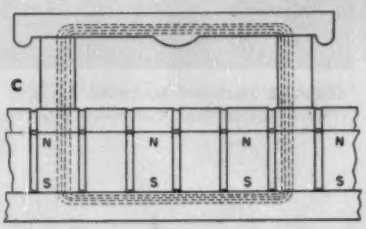


FIG. 5 ... WORK PLACED ON PARALLELS to clear projections (exaggerated) requires special care. In "a," lines of force crowd together to form the shortest complete circuit, as is their nature, and only the parallels are gripped. Parallels are shifted in "b" so that each one rests directly on a magnet-bar. No return bar is included in the arrangement, hence the magnetic circuit is incomplete and there is no grip. Correctly positioned parallels, "c," provide one on the magnet bar and one on the return bar. Thus the circuit is complete, going from magnet through parallel, work, parallel, return, bar, base, and back to magnet; the work is firmly gripped

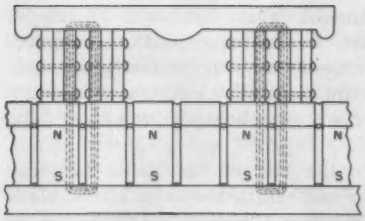


FIG 6 ... MAGNETIC PARALLELS are made for use with magnetic chucks. Not permanently magnetic in themselves, they consist of laminations of soft iron plates interspersed with brass (or similar low permeability material) plates. The plates usually are assembled with brass rivets and the iron plates are sufficiently thin that they cannot bridge a magnet and a return bar. Again, the circuit between the chuck and the work is complete. (Only one flux path, of many, is shown for each pair of parallels)

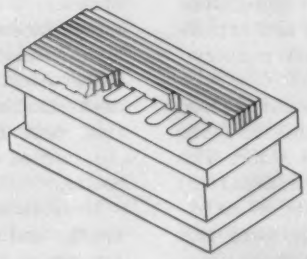


FIG. 7 ... FOR SMALL PIECES, an auxilliary top plate is available for use with the magnetic chuck. It, too, consists of alternately laminated soft iron and brass plates but these laminations run lengthwise on the chuck. Ordinarily they would "short" the magnetic field and destroy the grip, however the laminations are notched on their lower edge. Every other iron lamination is notched so that it contacts a magnet and each iron lamination in between is notched to contact only a return bar. Parts covering two or more iron laminations are gripped. Top plates are made for specific chucks; *are only interchangeable with chucks having the same magnet and return-bar spacing*

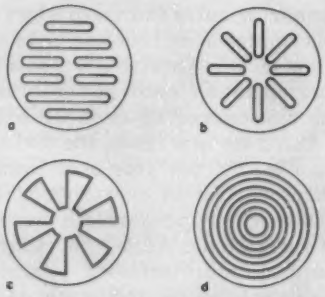
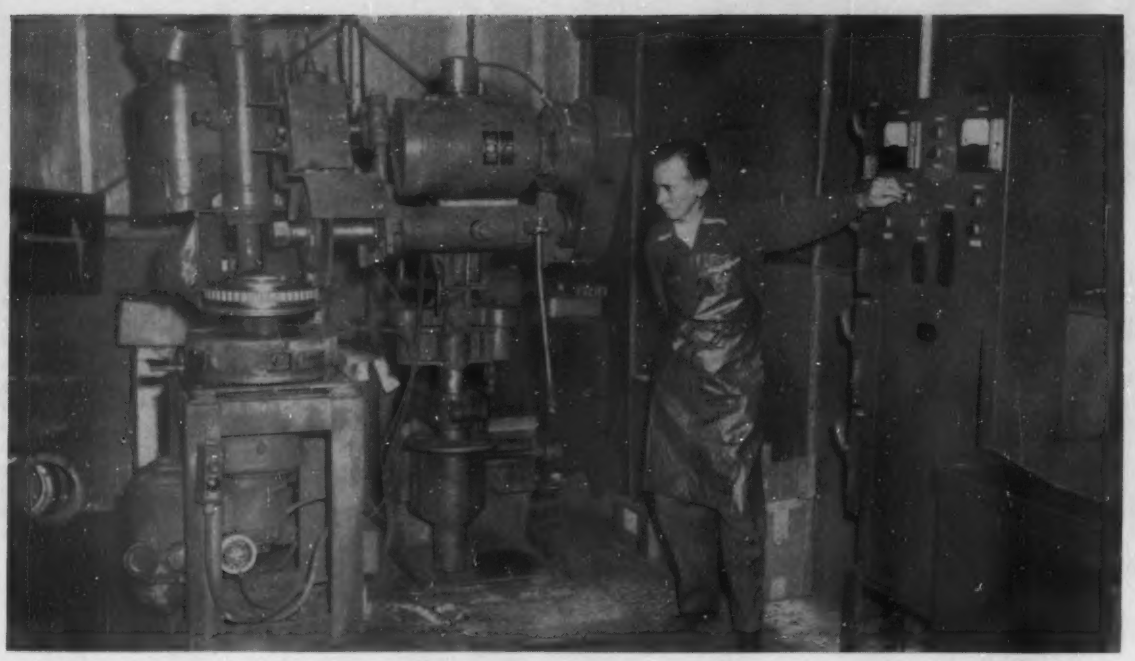


FIG. 8 ... CIRCULAR MAGNETIC CHUCKS are designed for use on lathes, internal and external cylindrical grinders, and rotary-table surface grinders. Face patterns vary with manufacturers and applications. "a" and "b" have individual magnets set into the body. Chuck "c" has a single magnet set into the body and "d" has magnets within the body and notched concentric "laminations," similar to Fig 7, which form the top plate. Operating principles are the same for all chucks



COMPLETE BRUSHING MACHINE, including variable-speed worktable, vertical and horizontal brushes, and panel control board. Work piece is turbine disk. Compressor disks and other parts are also processed on same machine

Automatic brushing deburrs

Shop-made brushing machine achieves lower costs, higher production, improved surface finish, and more uniform results

Removing burrs and sharp edges from blade grooves on compressor and turbine disks at the Westinghouse Aviation Gas Turbine Div was a tedious and expensive operation until power brushes and a special machine teamed up to do the job.

Using the new setup, the division now saves more than $41,000 per year over hand-finishing methods on production of experimental engines alone. The first year's savings are more than twice the initial cost of the machine. Aside from reducing costs, other advantages are: increased production, uniform and consistent results, and improved surface finish.

The machine consists of two brushing heads and a variable-speed turntable. A panel board is used to set timer controls and brush directions manually. After these adjustments have been made and the work placed on the turntable, the machine becomes completely automatic. The work revolves and the brushes make contact until a predetermined time cycle has elapsed. Then the brushes automatically back off, stop, and begin rotating in the opposite direction for a corresponding time.

The heads are positioned 90° apart at the edge of the turntable. One brush operates on a vertical axis; the other on a horizontal axis. The brush on the vertical head consists of five ½-in.-wide Tampico brushes 12 in. in diameter, giving a 2½-in. maintained face width. The brush on the horizontal head is a special 14-in.-dia Tampico brush of master wheel construction. In this case, a short trim and dense face are necessary to provide fast brush cutting, with minimum flexibility. Brush speeds are constant at 1000 rpm, each being driven by a 5-hp motor.

Brushes deburr the OD of the disks (vertical brush) and deburr and radius the sides of the blade grooves on the same disk (horizontal brush).

Only one operator is required. His duties are to place the work on the turntable, adjust the time settings, and maintain constant brush pressures. Brush pressures are registered on ammeters connected to the brush motors and located on the panelboard where the operator can make necessary adjustments. This is one of the most important features of the operation, in that constant brush pressure provides uniform radii on all pieces, reduces brush wear to a minium, and provides a true brush face.

A break of 0.005 to 0.015 in. is required on each segment of the OD, and 0.010 to 0.025 in. is required

VERTICAL AND HORIZONTAL BRUSHES in operating position for deburring compressor disk. Note short trim on vertical brush

BREAK PRODUCED on blade groove edges by short-trim brush with abrasive compound.

turbine disks

R DePASTINA, mfg engrg consultant, R E EYRE, methods engineer,
Aviation Gas Turbine Div, WESTINGHOUSE ELECTRIC CORP

on the blade groove sides. Actually, most of the cutting is provided by a 180-grain abrasive compound applied to the brushes by an automatic compound applicator mounted on each brushing head. The amount of compound can be increased or decreased, depending on the nature of the work being processed. This is determined by the number of contact pads attached to the periphery of the turntable.

The turntable has a variable-speed drive with a range of from 5 to 40 rpm. The turntable itself is actually a large three-jaw chuck that makes it applicable to most fixtures. Of course, the wide speed range is advantageous when a variety of work is involved. Workpieces from 18 to 48 in. in dia. can be processed. There is a tendency to roll over the burr if it is too large to be removed with the brush. However, proper tooling on previous machining operations eliminates these excessive burrs.

Most of the disks are aluminum and stainless. Average time cycles for deburring compressor disks range from two to four min per side; for turbine disks, from one to two min. The difference in time is because the blade groove designs are different in spacing and angle. Brushing time is the important factor that controls acceptance or rejection of disks. For example, tests have shown that prolonged brushing on the acute angle of the blade groove produces a flatness on the edge that is actually a sharp chamfer. This is not acceptable from a stress standpoint.

Mechanical deburring with power brushes is a partial solution to some stress problems that have occurred on disk parts. It is believed that there is less stress concentration on brushed edges because they are smooth and uniform; old methods of hand scraping and filing left tool marks that were potential starting points for fatigue cracks.

To eliminate trial and error brushing on these parts, a process specification was prepared covering the entire operation in detail from beginning to end. Also, included in this specification is a complete listing of all materials used, how they are used, and where they can be procured. A job-record card system was set up at the installation, giving specific time cycles for every type of disk to be processed, thus insuring repetitive results of the same high quality.

This deburring and finishing of compressor and turbine disks is only one application of the new machine. Using it, many other parts undoubtedly can be deburred and finished successfully.

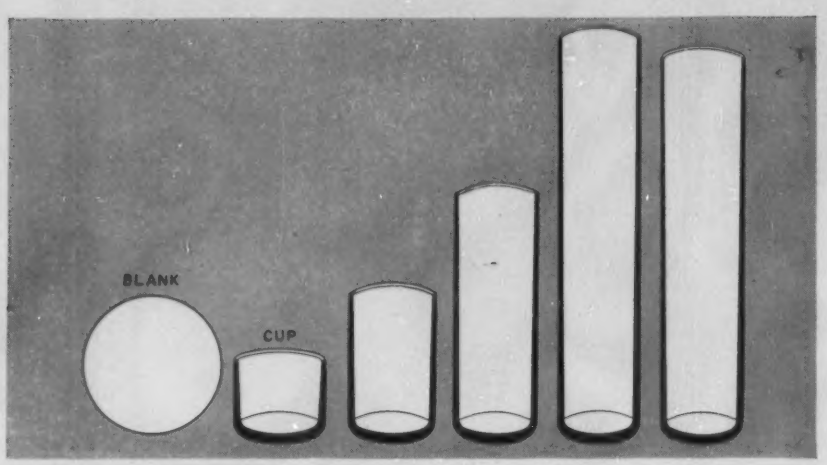


FIG 1 .. Five drawing and redrawing operations are performed on a purchased blank, to produce a brass cartridge case. The shell is reduced to 70% of the blank dia, and the reduction of the side walls by ironing is 30% at bottom and 50% at top

Cope Talks on Draw Dies...XIV

Three shell jobs typify ironing

These jobs show the application of dies discussed in Installment XIII, and introduce further tooling designs. In addition, the author gives you some rules for ironing speeds and permissible reductions

A series of operations for drawing and ironing a cartridge case preparatory to the heading and indenting operations is shown in Fig. 1. The case is drawn from 70:30 brass with a Brinell hardness of 43 to 65 (500 kg load) and a tensile strength of 40,000 psi. The flat blank is purchased, to reduce waste and eliminate handling of scrap material.

The blank is placed with the sharp edge down in a drawing or cupping die similar to that shown in Fig. 2, and is drawn and ironed to the shape illustrated. The shell is reduced to 70% of the blank diameter; and the percentage of reduction in ironing varies from 30% at the bottom of the cup to 50% at the top. These reductions are considerably more than is theoretically practical in cold working of cartridge brass, but no trouble is encountered when carbide dies and chromium-plated punches are used.

In contrast, ordinary practice followed in cupping operations is not to exceed a total reduction of 50% for both drawing and ironing operations. That is, if the shell is drawn to a diameter equal to 70% of the blank (30% reduction), the metal should not be reduced in thickness more than 20% in the same operation.

Cupping dies must be carefully designed and accurately built. The drawing edge, or mouth of the die, must be properly shaped in order to produce

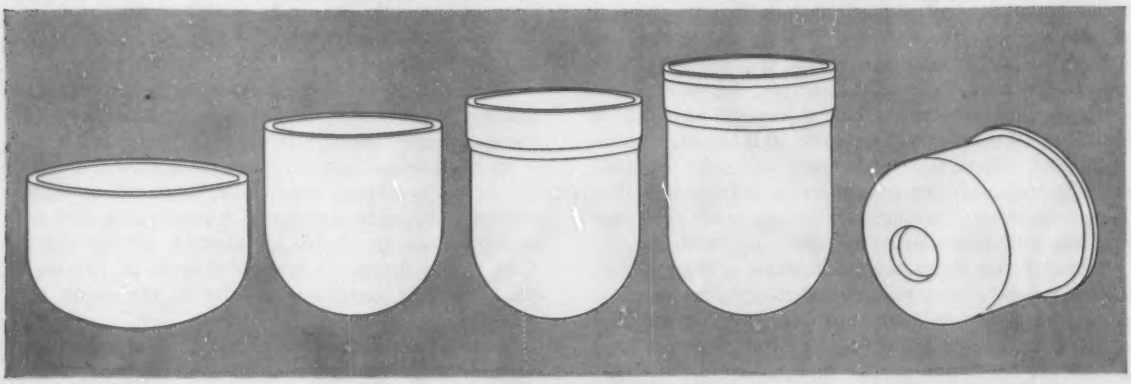


FIG. 3 .. Aluminum shell for propeller dome is ironed in last two operations. These steps reduce the shell wall thickness from 0.565 to 0.218 in., a reduction of 60%

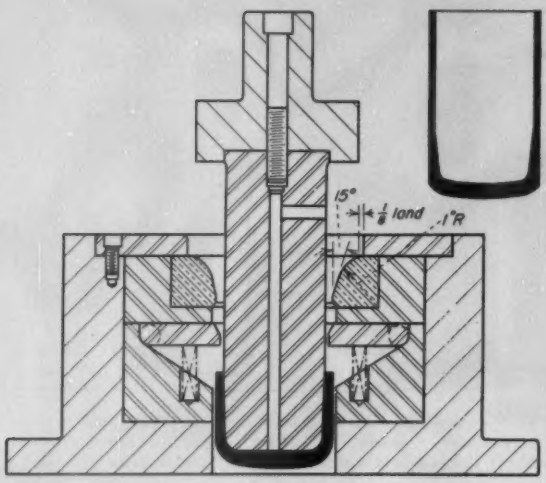


FIG. 2 .. Cupping for the brass cartridge case is done in a die with a carbide draw ring having a 15° drawing angle and a radius equal to 225% of the blank thickness

operations

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a cup with an even top edge so that the shells need not be trimmed between redraws. The carbide insert should be laid out with a ⅛ in. land, 15° drawing angle, and a radius equal to approximately 225% of the thickness of the blank.

It is also advisable to serrate the end of the punch. Ring-like serrations help to maintain uniform wall thickness and cup height, and also prevent metal at the base from drawing into the side walls. Rings, or serrations, left in the cup are ironed out in the heading and indenting operations.

The walls of the cupped shell are further reduced in thickness, and the length of the shell is increased in three succeeding operations in dies similar to that shown in Fig. 3, Installment XIII (*AM*—June 7, 1954, p 135). A drawing or ironing angle of 20° is used with a ⅜ in. radius at the intersection of the draw diameter. Wall thickness of the cup is reduced 32% at the bottom and 66% at the top in the first redrawing operation, as shown at the upper right of Fig. 2. The wall is reduced approximately 30% for each succeeding redraw.

In manufacturing cartridge cases, it is the usual practice to reduce the inside diameter of the first cup to approximately the same diameter as the inside of the finished case. This practice allows a greater percentage of reduction for ironing in subsequent operations, because it is necessary only to reduce the diameter of the shell sufficiently to permit the ironing punch to enter freely.

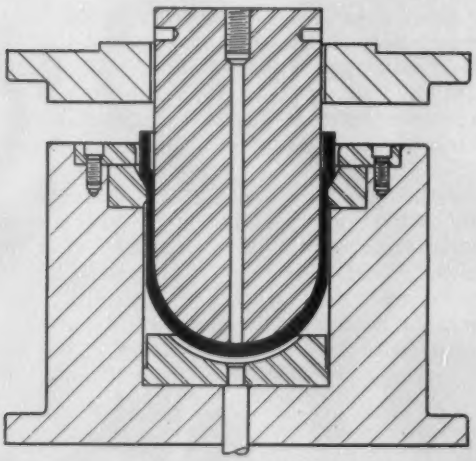


FIG. 4 .. Ironing of the aluminum propeller dome is done in a die equipped with a stripper and a bottom knockout, so that the shell cannot stick in the die or to the punch

IRONING OF STEEL

At one time, ironing operations on steel shells were more or less limited to correcting the natural taper in the walls of a drawn shell, and to produce a straight, smooth surface to an accurate diameter. It was regarded impractical to reduce the wall thickness of steel shells an appreciable amount. The reasons for this practice were: (1) the tendency of steel to flake off and load the die, and (2) the high pressures required because of the material's great strength. Besides, an old rule of thumb limits the cold drawing of steel to the ratio of 3:1; that is, the finished shell should be no longer than three times the blank diameter.

These old rules have given way to progress. Millions of steel shell cases, ranging from 0.22 cal rifle ammunition to 105-mm howitzer shells, are being drawn in a ratio of seven or eight to one. To provide steel that produces a satisfactory cartridge case, the American Rolling Mill Co. developed a special material that is nothing more than a medium commercial grade, somewhat better than automobile fender stock, but lower in carbon content.

Expansion and contraction properties are important, as when a shell case is fired, but plain dead-soft, deep drawing steel is satisfactory for articles other than cartridge cases.

Prior to development of steel cartridge cases, it was not considered practical to reduce the wall thickness more than 10% in one operation when ironing steel. This figure has been appreciably exceeded in the armament program.

IRONING OF ALUMINUM ALLOYS

The sequence of operations for drawing and ironing a large propeller dome from 9/16 in. thick, 61S aluminum alloy sheet is shown in Fig. 3. The dome is drawn in ordinary dies in the first two operations, and subsequently the side walls are reduced in thickness in two ironing operations.

In the first ironing operation the side wall is re-

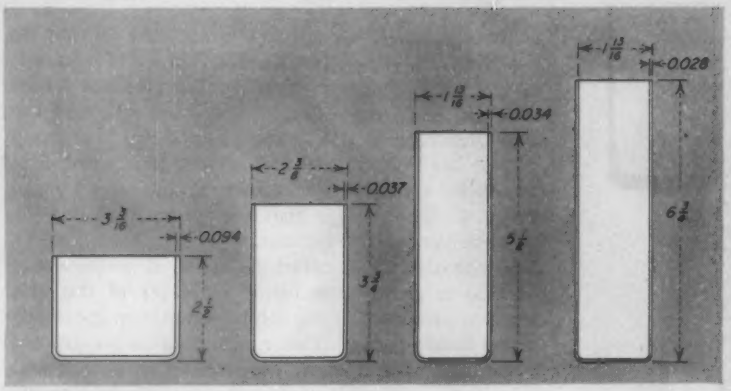


FIG. 5. . Shells made of soft, ductile materials may be reduced in diameter and in wall thickness by turning them inside out

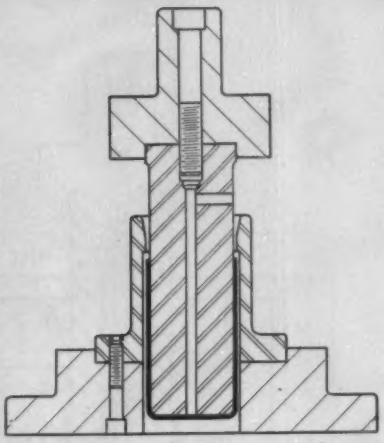


FIG. 6 . . First-operation shell of ductile material is placed over die and drawn inside out by the punch. The drawing action reduces both the side wall and the bottom thicknesses

duced from an approximate thickness of 0.565 to 0.385 in. In the second operation the wall is reduced to a final thickness of 0.218 in. Both operations are performed in a 1500-ton hydraulic double-action press in dies similar to that shown in Fig. 4. The walls are reduced in thickness by forcing the shell through a die ring of the correct diameter.

DRAWING AND IRONING

As previously stated, when shells are to be thicker at the bottom than at the sides, it is the usual practice to draw the shell first to its approximate finished size with uniform stock thickness and then reduce the thickness of the side walls by separate ironing operations. However, if the metal is very soft and ductile, shells may be reduced both in diameter and in wall thickness by turning them inside out during the redrawing and ironing process.

An example of this type of work is shown in Fig. 5. The shell at the right is drawn and sized in four operations from Britannia white metal, an alloy of 50% antimony, 25% bismuth and 25% tin.

In the first operation the shell is blanked and drawn to a diameter of 3 3/16 in., without thinning the metal, in a combination die. Next, the shell is placed in the die shown in Fig. 6 and is reduced to a diameter of 2⅜ in. In the same operation the shell walls are reduced from 0.094 to 0.037 in. thickness. Without annealing, the shell is turned inside-out again and is reduced to a diameter of 1 13/16 in., but the side wall is reduced by only 0.003 in. The shell is sized to 0.028 in. thickness in the fourth operation.

DRAWING AND IRONING SPEEDS

Ironing, or crowding back, a portion of a shell wall is in the nature of coining. The operation must be performed slowly and at a uniform speed to allow the metal to flow and adjust itself to its new position. Otherwise the metal may tear, or a straight smooth surface will not be produced.

Cupping or drawing operations in brass are performed at speeds as high as 75 fpm. Redrawing or ironing operations are performed at speeds ranging from 35 to 70 fpm, depending upon the amount of elongation of the side walls. Steel should not be cupped or drawn at speeds greater than 55 fpm, nor ironed at speeds greater than 20 fpm.

LUBRICATION

Lubricant must be very "tough" and have great adhesive power and high viscosity, even at elevated temperatures, to withstand the combined action of stretching, high pressure, and heat developed during ironing operations. Many lubricants which are successful for plain drawing become very fluid when heated and are not satisfactory when the same metal is ironed. In addition, the lubricant must have sufficient spreading power to coat the entire surface. In general, high viscosity and spreading power ore opposed to each other.

ANNEALING BETWEEN OPERATIONS

Severe cold working, as during ironing, strain hardens metals rapidly and makes it necessary to anneal shells between redraws. Otherwise the metal becomes too brittle.

Brass shells should be heated to a temperature not to exceed 1150 F. for a sufficient length of time to obtain the following grain sizes:

After cupping and first redraw, 0.060 to 0.030 mm.

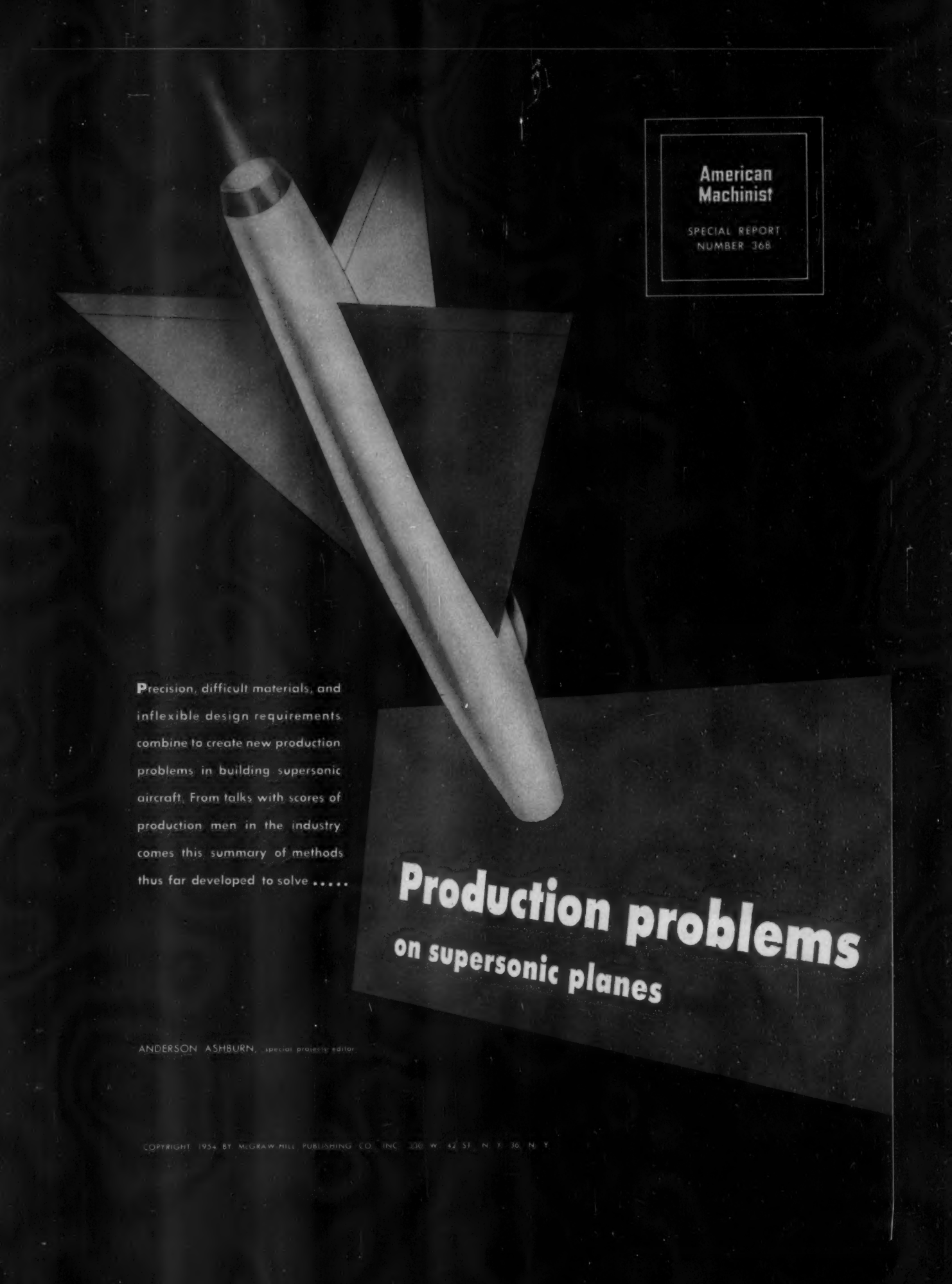
After intermediate redraws, 0.55 to 0.070 mm.

For final redraw, 0.030 to 0.045 mm.

The length of time at heat may range from 10 to 30 min., depending upon the size of the shell, its wall thickness, and the type and capacity of the furnace.

Steel shells must be annealed at the correct temperature, and for an exact period of time, under close atmospheric control. The usual method is to place them in metal baskets and send them along a roller conveyor through a rigidly controlled, gas furnace of the roller-hearth type, in which the temperature is maintained at around 1300 F. The full cycle of heating and cooling takes about 90 min.

Part XV of Mr Cope's series will appear in an early number.



American Machinist

SPECIAL REPORT
NUMBER 368

Production problems on supersonic planes

Precision, difficult materials, and inflexible design requirements combine to create new production problems in building supersonic aircraft. From talks with scores of production men in the industry comes this summary of methods thus far developed to solve .....

ANDERSON ASHBURN, special projects editor

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Machining . . .

When an airplane crosses the much-publicized sonic barrier, sound waves pile up, like a cresting wave, until they reach explosive force. This sonic boom, which can be pointed like a gun, has been proposed as a possible weapon, but so far has been only a nuisance where accidental discharge at inhabited areas has broken windows, rattled dishes, and set local rumours soaring.

This strange, still unfamiliar problem is one of the many posed by supersonic flight. Design and engineering of the plane itself have, in general, outdistanced production know-how. The designer can —he must—dictate his requirements with little or no regard for their producibility. Production departments then have no choice but to find some way of producing them.

As yet there is little standardization between plants in these methods, for no one method is accepted as the ideal solution to a given problem. Thus this summary is an interim report. Many of the methods have been reported in AMERICAN MACHINIST in earlier issues, often in earlier stages of development. Many are reported here for the first time. Further details on these will appear in future issues as more is learned about them.

One plane already calls for a carry-through forging beyond the capacity of existing presses. As an interim measure, it is hogged from the solid, starting with 75S rolled 3-in. plate in a size 4½x9 ft. This 1500-lb plate is machined down to a 150-lb "forging" in four setups on a Keller machine.

Other machining methods, such as routing, for this part are being investigated, or it may become an actual forging on a heavy press when presses that could handle the job are available. As a forging, with current practice, it will still have to be machined all over in basically the present setup (though total machining time would be reduced).

The general trend toward larger contoured parts machined from forgings, or hogged from solid blocks, has required the use of machines whose past use has been primarily for die sinking, such as Pratt & Whitney's Keller and Cincinnati's Hydro-Tel. One subcontractor will shortly have 28 Keller machines operating on parts for a single plane. As the requirements for finish-machining aluminum are somewhat different from those for roughing out steel dies, the machine has certain shortcomings. A typical part, for example, requires tolerances of 0.0005 in. over a 20-ft. length. Keller machines now being built for the aircraft industry incorporate changes to meet these new requirements.

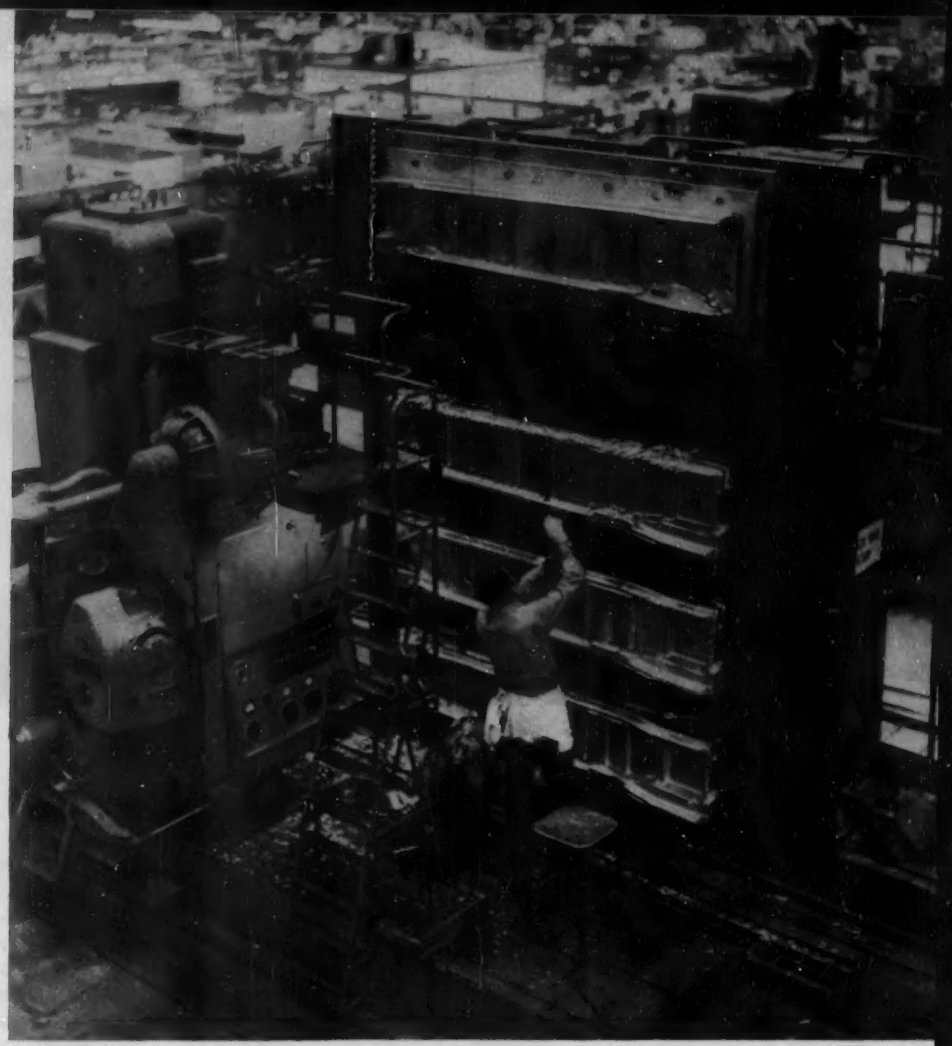
HIGH-SPEED MILLING

A research project by the Air Force to develop information on high-speed milling resulted in development of a test machine by Cincinnati Milling Machine Co that was evaluated by Convair Ft Worth (*AM*—Feb. 16 '53, p201). The 18x48-in. vertical mill has spindle speeds up to 10,700 rpm at 50 hp and table feeds to 375 ipm. (After completion of the tests, Convair was allotted the machine, is now using it for regular production work.)

Evaluation tests indicated that average finishes of 10 to 20 mu in. rms could be obtained at feeds of 175 to 250 ipm. Longer tool life was possible, combined with a high degree of accuracy. Absence of heat in the work practically eliminated the problems with warpage in 75ST.

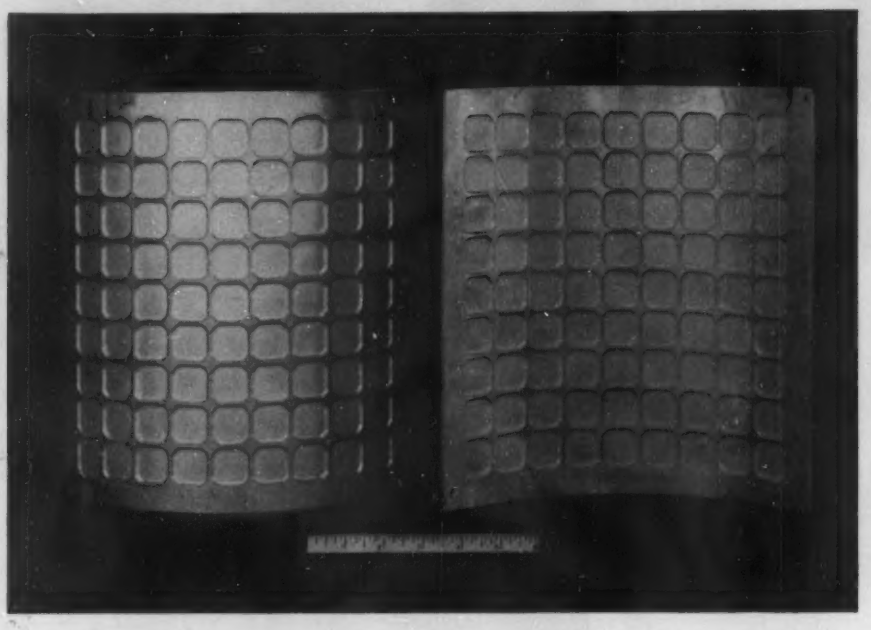
Cutters had to be modified. Face-milling cutters are made of forged bodies with one inserted carbide tooth per inch of diameter. Teeth have 30° axial rake, 20° radial rake, 10° clearance angles without land, and 1/64 in. x 45° chamfer. Cutters must have both static and dynamic balance. Mist cooling was found desirable.

End mills are high-speed steel with 30° left-hand



KELLER MACHINE contour-mills large forgings, three at a time, at Chance Vought. At some plants, parts are now so big that only one part can be handled at a time, or even only a section of one part

ALUMINUM FITTING is profiled in 11 min (instead of former 72 min) on old Morey profiler with Tru-Trace hydraulic tracing valve. Operator follows templet with valve stylus that hydraulically controls longitudinal movement of table, traverse of head. Two-lip, high-speed, end mill operates at 1800 rpm, gives 80 to 100 mu in. rms on 75ST



WAFFLE PATTERN ETCHED in two formed parts by masking off areas not to be reduced. These sections are joined to form stiff sandwich. Process, developed by North American, is licensed by Turco Products

helix. Clearance angles had to be modified to 18° to prevent clogging with chips. Best feed rate for rough cuts on slots seemed to be 80 ipm; finish cuts could be taken at 150 ipm. When end mills were cutting on only one side, 375 ipm (limit of the machine) was satisfactory for roughing.

Most effective use of the machine was in face milling where better finishes were obtained at production rates more than four times that of standard vertical mills.

Douglas El Segundo has installed several high-speed Hydro-Tel machines equipped with 3-dimensional pencil tracers and spindle speeds of 3,600, 7,200, and 14,400 rpm. Top speed is for use with small end mills. Several plants have Onsrud heads that have speeds of 14,000 rpm.

In general, machining 75ST does not seem to cause the difficulty that it once did. Warpage is probably the major problem. It can be minimized by doing as much machining as possible before aging, by high-speed machining, or by stretcher leveling the stock before machining.

Vacuum clamping has been extended to forgings. At McDonnell, a plastic nest is molded around the part and routed out to fit the vacuum plate. This provides an economical way to hold small lots of odd-shaped parts and may be the only practical way when the entire top surface must be kept free for milling. Such methods eliminate clamping distortion and, in machining thin sections that can't support themselves, permit close tolerances by vacuum clamping from the opposite surface.

WING SKINS

The skin of an airplane has gone far beyond the plain sheet of polished aluminum riveted to a series of stiffeners. Skins are thicker to act as load members themselves. To keep weight down (and reduce the load that must be carried by other sections) thick skins taper from root to tip. Tapered skins are rolled with success in the smaller sizes, machined to a taper on a skin mill, or ground to a taper on a belt grinder.

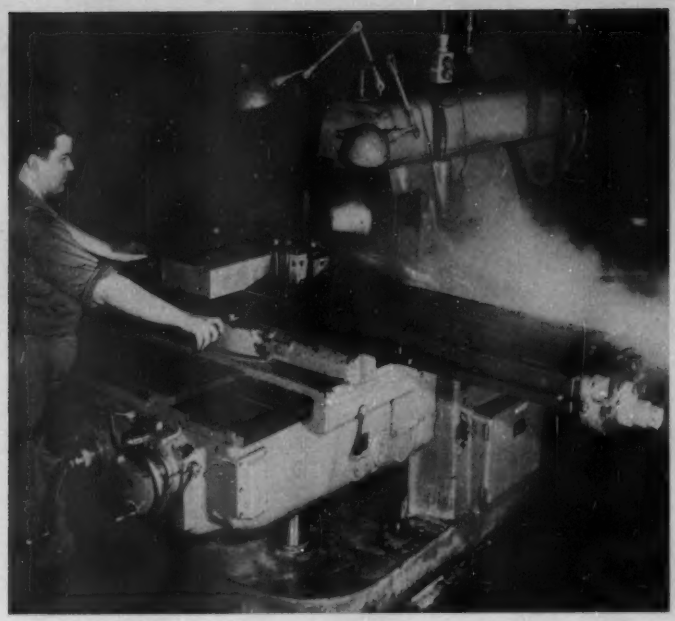
Skins may be milled out on the inside to reduce weight in some sections, or equipped with integral stiffeners to further reduce weight and assembly operations. Typical of the saving is a 4x8-ft integrally stiffened skin at Douglas El Segundo that eliminated 28 parts and 1300 rivets.

Methods attempted to produce integrally stiffened skins include etching, rolling, extruding, casting, and machining. The only method generally accepted as satisfactory thus far is machining. Major step in developing methods for this was the Giddings and Lewis skin mill installed by Lockheed. Later G & L skin mills have improved characteristics and larger capacity. Douglas El Segundo has recently placed a mill in operation with a table to handle plate 10 ft wide and 40 ft long (part of a group of elephant machines all standardized for 40-ft parts). One of the three Onsrud cutting heads is templet guided in 2 planes, the other two in one plane.

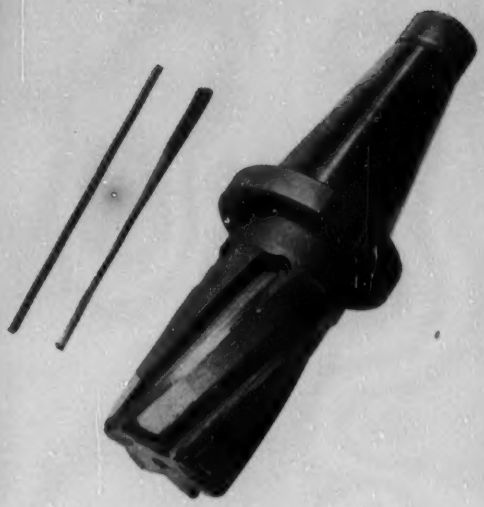
Other approaches are moving in both directions from this machine. At North American, an electronically controlled skin mill now under construction has a table 18 ft wide and 25 ft long. It will produce two skins at once.

Also at North American, in an attempt to simplify the equipment required, a "beam mill" has been developed. This mill has a fixed table to which the skin is clamped by the usual vacuum means.

The single 60-hp cutter head is mounted on a box beam above the table. This beam is supported at



CONICAL HELICAL CUTTER, 14-in. dia, at Boeing is balanced to operate at 1250 rpm and 60-ipm feed in making ½-in. cut in 75ST



CARBIDE IS TWISTED AND BENT to helical form for milling cutters at Boeing

each end and ends are positioned independently and locked for each cut. A 2-tooth flycutter operates at 3600 rpm as head travels at 100 ipm. A mixture of lanolin and kerosene is applied as a mist. Rise and fall of the cutter is controlled by a hydraulic tracer unit following profile bars mounted on the side of the beam. The machine is relatively simple in design and operation, is said to cost only about a fifth as much as a skin mill, but is not capable of the broad flexibility of the latter.

Most recent approach at North American is chemical etching. Areas to be removed are left exposed while the rest of the part is masked. The part is then immersed in an etching solution. Electronic control is said to permit control to 0.002 in. In addition to the possibilities this opens for sculpturing parts after they have been formed, it can also be applied to reduce entire parts that must be formed in a heavy gage (to avoid cracking) to a desired thinner gage.

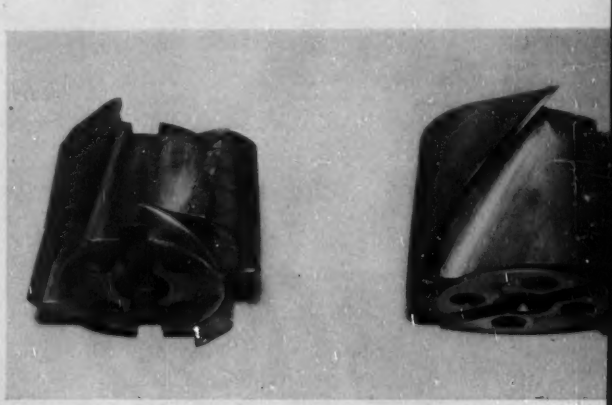
The most general interest, however, appears to be in some method of utilizing the router for skin milling. One of these is at Convair Plant II, San Diego, where two parallel tables (one above the other) hold work and templet. Work is clamped to the top of the lower table and the negative templet to the bottom of the upper table, both by vacuum of a special design.

Flycutter operating at 21,000 rpm is mounted on a router moved by the operator between the tables. Rise and fall are controlled directly by the templet as the head operates on a vertical slide, is held up against the templet by air pressure. Templets can be of track design to assure that a relatively unskilled operator covers the entire area in minimum time.

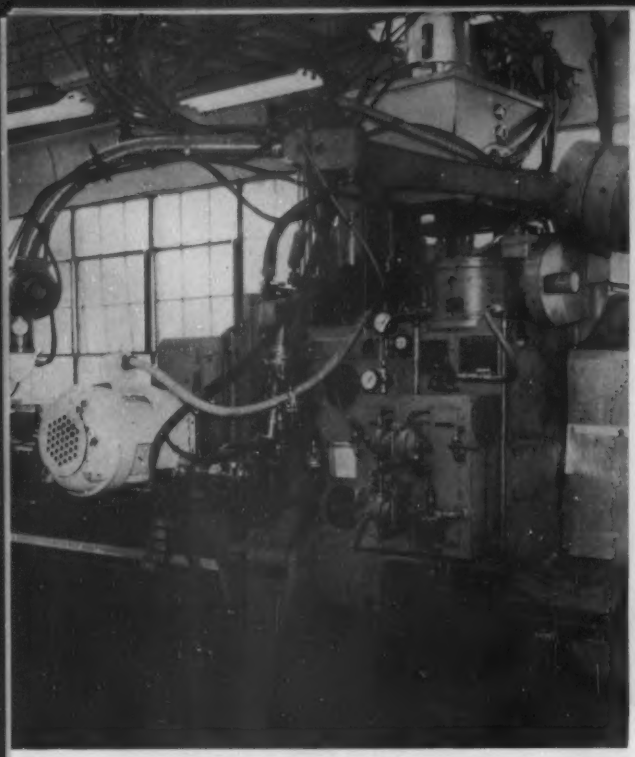
Tables are cast aluminum with an adjustable bridge structure to permit leveling to ±0.001 in. over 15 ft. The special vacuum arrangement, called an "octopus plate," consists of a series of annular grooves about 3-in. dia closely spaced in a geometrical pattern. O-rings for pressure sealing fit in these grooves. In the center of each of the rings thus formed, a hole is drilled and tapped, connected to a vacuum manifold, and sealed with a threaded plug.

To clamp a part to the table, the plugs are removed from those rings that will be completely covered by the part, O-ring seals are placed in the grooves around the unplugged holes. This method eliminates the tedious hand packing of sealing material around the part that is usually required.

A tracer-controlled router at Douglas El Segundo



TWO-BLADE HELICAL CUTTER (right) for spar mill at Convair San Diego (shown with former cutter) is 6-in. dia with 40° helix on carbide blades, can cut 75ST at ⅝-in. depth, 2½-in. width, 3600 rpm, with feed of 320 ipm. Similar four-blade cutter handles 1¼-in. depth cuts. Both are made by Sonnet Supply, produce 40 to 80 mu in. rms finish



TWIST MILLING OF WING SPARS at Convair San Diego has been simplified by modifying a Farnham spar mill. Cutter can twist 15° in a 21-ft spar. Original method was to twist head against force of counterweight by direct action of roller operating against templet at base of machine. Excessive wear on templet required replacement every 100 parts. Now roller operating on templet shifts cam which actuates True-Trace valve to apply 1500-lb hydraulic pressure against cutting head. Templet will last indefinitely

replaces the conventional folding arm with a straight arm made of two steel tubes sliding through bushings in a rotating column. The design will lend itself to power assistance operating along the lines of power steering.

HELICAL MILLING

One of the biggest boosts given to machining speeds has been the development of helical carbide cutters. This design had been common in high-speed milling cutters but was abandoned with the change to carbide tips.

At Boeing it was found that carbide inserts could be twisted successfully by placing one end in a vise and gripping the other end with pliers, heating the carbide to 2200 F with a torch and twisting and bending the carbide to the required form. As the cutters proved themselves, this primitive method was replaced by a machine to bend and twist the carbide accurately inside an induction coil.

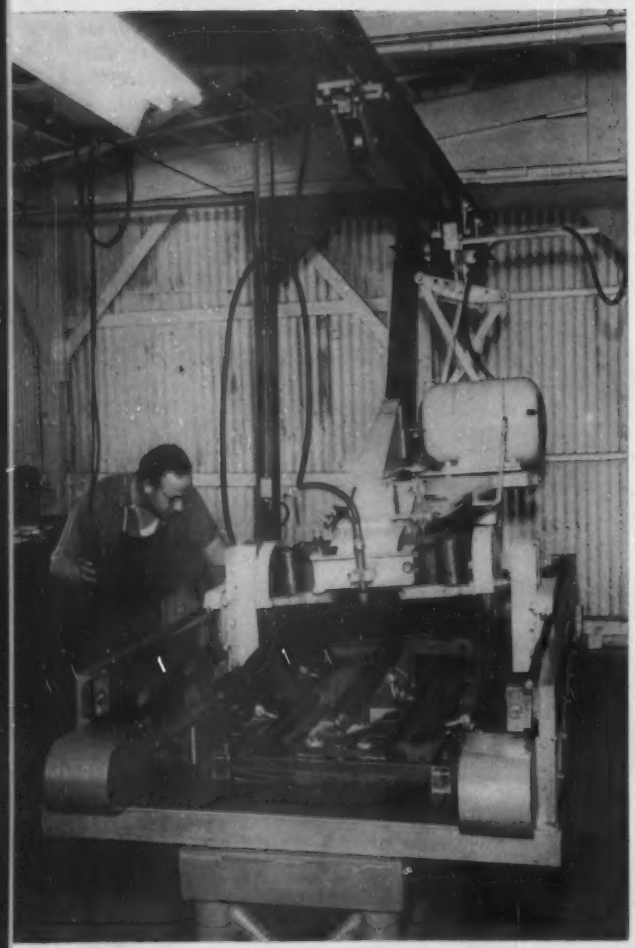
An example from Boeing of the results of this development is in the times on a wing stiffener 76 ft long. The cut is 1½ in. wide and varies in depth from about 1/16 to ½ in. With the orginal helical HSS cutter, two cuts were required at 50 ipm and time was 45 min; changing to a straight carbide cutter with 80 ipm, time was cut to 20 min. Now with a helical carbide cutter only one pass is required, producing 100 mu in. rms finish, and time is 7 min.

At Convair, where helix angles as high as 40° have been used, a spar-mill feed rate has been changed from 140 to 320 ipm with the helical cutters. Cutter operates at 3600 rpm and takes a cut 7/16 in. deep and 2⅞ in. wide.

TWIST MILLING

Spars run longitudinally in the conventional wing and can consequently take relatively simple forms. On delta wings, spars would have to radiate, like the spokes of a wheel, from the outer tip in order to follow element lines exactly. Because this construction is generally not practical, the outer surface of a spar must follow a compound curvature. There are other parts, in engine mountings, bulkheads, and other locations, where compound surfaces must be milled.

The fast simple way to make these cuts is by twist milling. Ideally, the cutter spindle must pivot around the heel line. This can be accomplished by mounting the spindle in a quadrant whose focal



COMPOUND CONTOUR is ground on weldment at Rohr in this modified grinder. Wet-belt operation, driven by 10-hp motor, has shaft supporting the pressure wheel riding on two cam plates. Plates can be changed to suit contour required

point is at the line of contact between tool and work. Such machines are under development by several companies. To provide tracer control and universal twist requires an extremely complex machine, so the first models will generally have a single-twist motion. Some spar mills are already equipped with such heads.

For example, the new spar mill at the Torrance facility of Douglas El Segundo combines six conventional heads with two twist heads. Twist is controlled by a spiral cam that can handle a 60-ft run along the 308-ft bed of the machine. (Purpose of the long bed is to clamp several spars along the table, let each head repeat the same cut as it travels down the bed.)

A variety of other methods have been tried. A spar cap can be twisted into a fixture that holds it so a flat cut is taken. After machining, the part is removed from the fixture and springs back to original shape with the required contour on the outer surface. This method is only practical when the amount of curvature is limited.

Another approach is the rocking fixture designed to shift on the table as the cutter passes over it. A metal templet (acting as a cam) operates against a roller on the column to obtain the twist. Either the weight of the fixture or spring pressure can be used to hold the templet against the roller.

A Fox belt grinder has been rebuilt at Rohr to grind compound curvature on torque bulkheads. A double set of cams is installed on the table with the bulkhead located between them. As the pressure wheel traverses over the table, the shaft of this wheel rides on the two cams, twisting to follow the contour. The abrasive belt is flexible enough to absorb the twist between the drive wheel and the pressure wheel. Chance Vought has applied this same principle to a rocking fixture for milling.

HIGH HEAT-TREAT STEELS

Lockheed has found that SAE 4340 steel can be heat-treated well above the usual 200,000-psi tensile range and still retain toughness suitable for aircraft construction. Engineers there are using a number of parts, primarily in landing gear, heat-treated to 260-280,000 psi tensile.

Other aircraft companies are watching the Lockheed experience with great interest and conducting their own tests. Douglas is reported to have reached the 300,000-psi level satisfactorily and some engineers feel that much higher levels are possible—perhaps eventually 500,000 psi for certain specialized applications. At the levels already reached, steel is in effect one-third lighter in its strength-weight ratio than at conventional levels.

At Lockheed the general practice for heat-treating SAE 4340 to the 260-280,000 level is to normalize, harden by oil quench, and temper. The cycle for parts machined from 2-in. bar is normalize at 1600 F for 4 hr, austenitize at 1475 F for 4 hr, oil quench, temper for 8 hr at 400 to 500 F. This is followed by a 24-hr bake at 250 F (after all operations above this temperature are completed).

Controlled-atmosphere furnaces or neutral salt baths are required for heat-treatment unless at least 0.020 in. is to be removed after hardening. When fatigue must be considered, parts that are not finish machined after hardening are shot peened.

When grinding or cold straightening are necessary after treatment, these operations should be followed by a 4-hr bake at 375 F and shot peening. Parts should also be baked for 4 hr after pickling or electrolytic or phosphate cleaning and for 8 hr after electroplating, at 375 F in either case.

As little machining as possible is left until parts have been hardened to 260-280,000 psi. Extreme rigidity is required in machines, tools, and fixtures, making it advisable to use machines larger than would otherwise be necessary.

Carbide tools of the new 350 grade seem to give the best results with tool geometry essentially the same as for conventional steel machining. HSS tools wear so rapidly as to be impractical for most cuts.

Turning will produce surfaces better than 100 mu in. rms at 450 sfpm, feed of 0.002 ipr, and depth of cut under 0.060 in. However, machining after treatment should be limited to depths under 0.030 in.

Boring requires the same conditions as turning if the depth-diameter ratio does not exceed 2:1.

Thread cutting with single-point carbide tools is possible at relatively high cutting rates but tools must be inspected for chipping after each cut. External threads should have a diameter greater than ½ in., internal threads a minimum diameter of 1¼ in., with 12 to 24 tpi in either case.

Cotter-pin holes in threaded surfaces are drilled and plugged (with the same steel) before heat treatment. The plug is removed after threading. Slots must be machined after heat-treat.

Fly cutting with carbide-tipped cutters and a rigid setup will provide 50 mu in. rms at 450 sfpm with light chip loads and minimum depths of cut.

Face milling requires inserted-tooth cutters and will work on either surfaces or slots with depths of cut under 1/16 in. Slitting cutters have poor life. Carbide end mills are fairly satisfactory at 100 to 125 sfpm with 0.002 to 0.004 in. chip load.

Drilling is not practical except with solid-carbide spade drills and these require sharpening after about one diameter of depth. The drillpress must be extremely rigid with low feed rates. Work should be submerged in tap water for cooling.

Reaming with HSS reamers is possible provided not over 0.005 in. is removed, but carbide reamers are preferable.

Tapping can be done 0.005 in. undersize before hardening and then enlarged with standard taps.

Grinding requires close attention to prevent cracking during grinding or the buildup of residual surface stresses that cause cracking at a later date. Grinding is slower than normal and requires special training of the operators, must be followed by a bake and shot peening. It is preferable to hone, lap, or polish when fine finish is required instead of grinding.

Machine time is generally about three times as great as for the lower-strength steels—but this longer time applies only to the relatively small parts of machining performed after hardening.

Heavy wrinkles on outside contours . . .

are limited by addition of draw ring . . .

Forming . . .

Changing requirements in forming stem largely from a growing need for precision. In a supersonic plane, specifications may call for skin sections to meet with zero gap and no more than 0.0005-in. step. On most present production models the gap is running around 1/16 in. Yet beyond this reason, in itself compelling, there are other attractions.

Precision forming may bring savings in the slower planes, where it is not an absolute necessity, by simplifying jig requirements and speeding the assembly job.

The aircraft industry has been berated for its reliance on handwork—the rows of benches at which wrinkles are removed from formed parts with such implements as lead pipe, leather mallets, and elbow grease. The fact is, of course, that the limited production of most planes and the frequency of design changes in production models, combined with the size of many parts, makes the use of matched metal dies with their expensive machining and trying run-in periods impractical. Even so, handwork is a sensitive point with many engineers in the aircraft industry, stimulating the search for better forming methods.

This search has brought many variations of the process developed by Henry Guerin at Douglas which forms shallow parts with rubber as one die. Stretch is now the magic word in forming. When you stretch you reduce the problems caused by springback and wrinkles. Increasingly, parts are stretch formed whenever possible and, in addition, stretch is being introduced in press operations that are not true stretch forming; for example, stretch can be introduced by locks in the form blocks.

Straight rubber forming is giving way to the Verson-Wheelon press (*AM*—May 12 '52, p202) in which pressure is applied to the rubber pad hydraulically by inflating a rubber bladder. Pressures are generally about 5000 psi, permitting heavier gages to be formed. By using softer rubber in the container (with hard rubber throw pads over the work), more uniform pressure is possible on sides of form blocks.

One of the simplest and most recent steps has been to increase the pressure in the basic Guerin process. At Northrup, the size of the rubber container has been reduced to increase the pressure from 1800 to 7000 psi, eliminating about 40% of the handwork.

Where metal must be shrunk into an outside flange, wrinkles are inevitable in the basic Guerin process (see below for ways to restrict them). Developments such as Hydroform and Marform (*AM*—Dec 10 '51, p140) permit deep drawing without requiring matched dies. Only the punch is required with the addition of a blankholder ring. In the Hydroform process a rubber pad backed by a controlled-pressure

to bottom third of flange

TO INTRODUCE STRETCH IN RUBBER-FORMED PARTS this method was developed at Temco Aircraft by William Phillips. Outside flanges normally have wrinkles from top to bottom (far left) when formed by Guerin process. Sometimes they crack, ruining the part. The Masonite draw ring and its metal base (costing about $15) limit wrinkles to an area where they can be more easily removed.

Form blocks are made with usual precision, but not the draw ring. The block is scribed and sawed to fit the outside of form block. Next the blank is laid on the nested form block and draw ring and one pencil line drawn around the blank, another on the side of the Masonite at the edge of the completed part. A bevel is cut between the two lines (usually about 30°).

A ½-in. base of 24ST, to which the Masonite is bolted and a pin fitted to hold the form block, complete the assembly. Two press operations are required. First, with draw ring in place, the blank is drawn smoothly over the flange, though bottom is left in a shallow U-shape. Second, with base and draw ring removed, the U is rolled out, leaving a few shallow wrinkles. Limited to outside contours, process works with both aluminum and magnesium

chamber serves as the female die, the punch is advanced by a hydraulic ram.

But the search continues for fast, simple methods to produce the smaller parts. At Convair, the "overpress" technique (*AM*—May 25 '53, p132) requires the forming of a heavy-gage steel part over the form block with a completed wrinkle-free part already in place. This steel overpress, dewrinkled, is held in position on the form block and blank by locating pins, serves as a female die. Lubrication of the blank is necessary and a pad of 85 or 90 Shore rubber instead of the conventional 60 Shore is required. Average cost of an overpress is $4 and wrinkles are virtually eliminated on many types of parts.

Many sheet parts are impact formed. In the familiar (to the aircraft industry) rope-drop hammer a Kirksite die and a lead punch are common. (The lead punch is required to adjust for misalignment of punch and die.) Introduction of the Cecostamp with its higher production rate and superior alignment has led to gradual replacement of the rope-drops and a shift to matched dies of Kirksite or cast iron. At the new Torrance plant of Douglas El Segundo, for examples, there is a single line of 11 of these hammers (see cover).

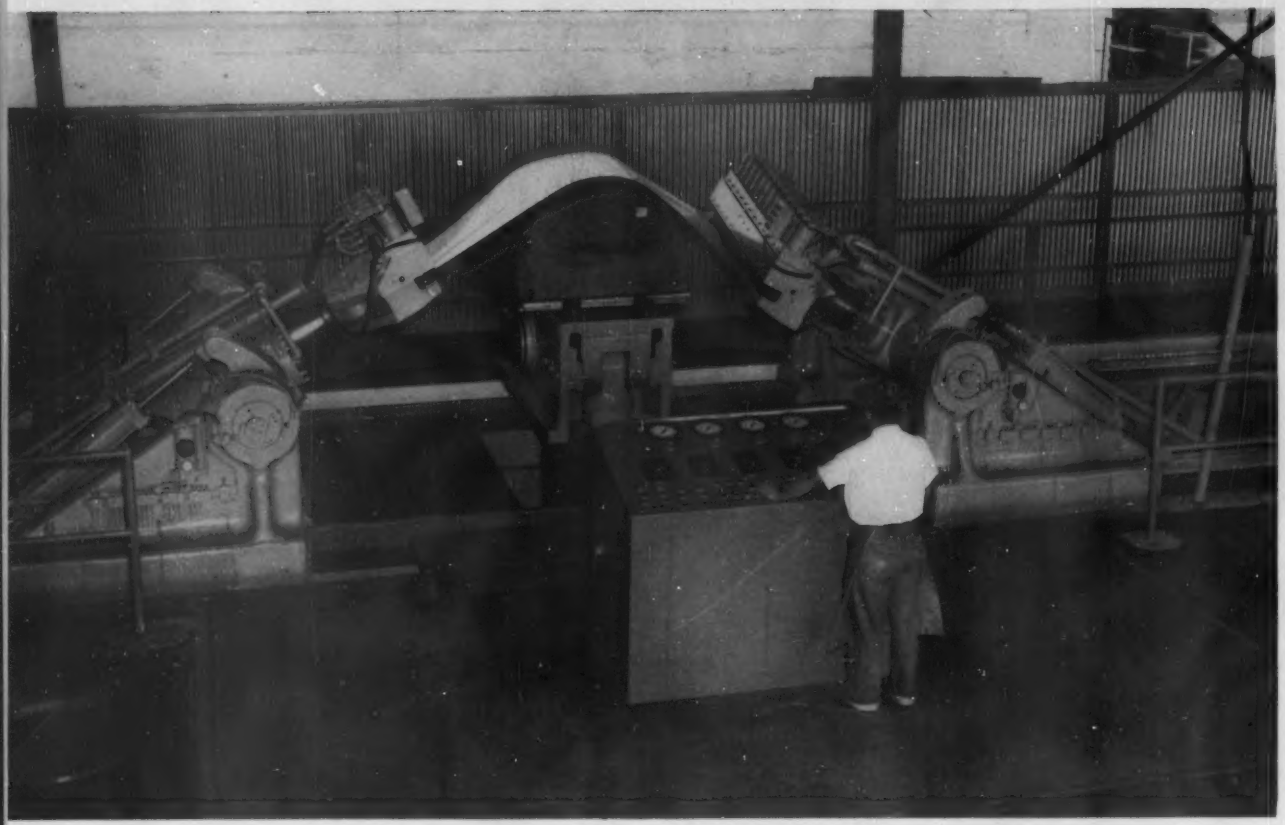
Impact rubber forming is also being adopted with these machines. At Convair San Diego, a Cecostamp with 40-in. bed is equipped with an 18-in.-dia base and matching rubber container, obtaining pressures of 10,000 to 20,000 psi. Form blocks are 17S aluminum, thick enough to keep the bottom of the formed part up at least an inch from the base because the impact will not extend down the side of the block to the base. This method has proved so promising that an oval container is being built with 24x36-in. base to handle larger parts.

INTEGRALLY STIFFENED SKINS

A whole series of new forming problems is posed by the integrally stiffened skins. Forming must follow heat-treatment before the material has had time to age harden. Large cold boxes are routine for holding the skins until they are ready for forming. In some cases they are moved from one plant to another in refrigerated trucks. But once they come out of the cold box, forming must be completed in 20 min or less.

Stretch forming is the favored method for skins without integral stiffening, though roll forming and press brakes are employed at some plants. Stretch forming may be either in sheet stretchers or in modified vertical hydraulic presses. Addition of integral stiffening complicates the operation but seems practical and is under development.

Another development is the pre-stressed hot-



250-TON STRETCH-WRAP MACHINE at Convair San Diego is typical of much new stretching equipment. This Sheridan will handle sheet 6 ft wide and 30 ft long. Die is mounted on hydraulic ram that is raised as jaws wrap sheet around it

forming process of North American. Here the sheet is clamped between dies and placed in an oven. Temperature is raised just enough to lower the yield strength to cause permanent set.

Lockheed is able to form skins by controlled shot peening, while at Douglas El Segundo the approach is an automatic press brake with 40-ft beam that will introduce the curvature through a series of separate bends. Length of stroke and feed of the work are automatically controlled by prepunched metal job tapes in this Verson press.

SANDWICH SKINS

A different approach is taken by several companies to the production of light, strong skins: Honeycomb construction. Sheets are first formed to shape and then bonded to each side of a shaped honeycomb stiffener made of aluminum, Fiberglas, or balsa.

Fiberglas logs can be sawed to approximate size (±0.005 in.) and brought to closer tolerances by sanding. At Convair Ft Worth, bonding is used to attach both metal stiffeners and honeycomb to sheet. Adhesive is applied as a tape to the skin, cured at 350 F for 30 min under pressure of 200 psi in areas with metal-to-metal bonding and 100 psi in the honeycomb area. On heavy sections this may require up to 2 hr in the bonding press.

At Chance Vought preference is for end-grain balsa bonded to aluminum in an autoclave at 280 F for 45 min to 2 hr with pressure of 50 to 100 psi.

Several other companies have bonded honeycomb to sections of wing skins as stiffeners, but continued developments indicate that large, formed wing skins with bonded construction and formed honeycomb can be expected.

CAST WINGS

Complete wings in limited size can be cast. At Chance Vought, for example, a cast missile wing is magnesium AZ63 with 0.20 in. thick skin and stiffening ribs. It is cast in a rammed sand mold with baked sand cores. Pouring is accomplished simultaneously from five ladles.

A cast magnesium section serving as a wing speed brake has 0.12-in. skin, while an elevon is cast with a steel torque tube in place for control. Some bulkheads and other large parts are cast rather than forged, but present feeling of most aircraft companies is that casting has fairly limited application to aircraft. If large sections of the zinc-zirconium alloy of magnesium ZK51 can be cast without zirconium segregation, casting may be more widely adopted.

Plastics . . .

Plastics are becoming a major item in both tooling and production parts. Laminated plastic has been widely adopted for drill jigs and fixtures, in some cases for structural parts. Cast plastics are common for stretch-form dies and are being applied to forming and forging dies in some cases. Epoxy resins are attracting much interest because with proper technique they have virtually no shrinkage.

For production parts, the familiar method of making a plastic part by laminating glass cloth with a thermosetting resin is being supplanted by mat molding. Boeing and Northrop are making extensive use of this method.

Spun, drawn, and treated glass fibers are collected in a "rope" of about 200 filaments. In one form of the process, the fibers are cut into 1- to 3-in. lengths which are randomly dispersed and deposited by suction on a moving conveyor similar to the process of paper making. The resulting mat is sprayed with a binder (compatible with the impregnating resin to be used later) for easier handling.

This mat can be sheared to shape and fitted by hand into the female die of a matched-metal set. A measured amount of resin is added, the dies are closed and heated to 200 to 250 F at pressures ranging from 15 to 50 psi. Variations of this method for complex shapes or limited volume employ wood, plaster, or low-melting alloy forms with pressure or vacuum bags and curing ovens.

Another approach that avoids the oven, is to use a single heated-metal female die and a rubber plunger so shaped that closing the press will force the resin evenly through the mat.

Matched metal molds generally require 3° draft angles, but give uniform parts with smooth surfaces and good production rates. With the rubber plunger as little as ½ to 1° draft is possible, and with vacuum or pressure-bag methods undercuts can be included, but in either case there will be some surface roughness on the side next to the rubber.

Latest development is to preform the mat to the shape of the part. Cut fibers are dispersed on a shaped screen by suction in a hatmaking machine. The resulting preform can be sprayed with a binder for handling, then impregnated and cured by any of the methods applied with sheared and hand-formed mat. Parts have more uniform properties, however, because there are no joints in the mat and the fibers are evenly distributed.

In this operation, suction draws the fibers against the shaped screen and as one section is covered, suction is reduced in that area so that fibers are drawn to another area not yet covered.

Mat molding can be applied through a wide size range, depending on available equipment. At Boeing, for example, parts range from a 2-in. cover to junction boxes 27x15x6 in. One rule for determining thickness is to add 1/3 to the aluminum thickness that would be required.

When production parts are mat molded in matched-metal dies, shear edges can be incorporated in the dies so parts come out ready to use.

CERAMIC COATINGS

Ceramic coatings for parts in exhaust systems are now standard practice. Both Ryan and Solar have processes in which the ceramic is sprayed on the part (usually about 0.002 in.) and then fired. Coatings were originally developed by the National Bureau of Standards. These formulations, plus some others that have been developed by industry since, are available. The thin layer of ceramic has some flexibility to bend with the part. The same coatings have possibilities for non-metallic dies.

Forging and extrusion . . .

Several forgings are already at the limits of existing capacity (Wyman-Gordon's 18,000-ton press at Grafton) and some of these are makeshifts in that carry-through forgings are produced in sections that are bolted together. There are other cases in which heavy plate is machined to simulate forgings beyond present capacity.

Most aircraft builders are moving slowly until they see what the heavy presses now being built will actually do and what tolerances and properties can be counted on. Once these facts are established, the trend toward larger forgings can be expected to accelerate.

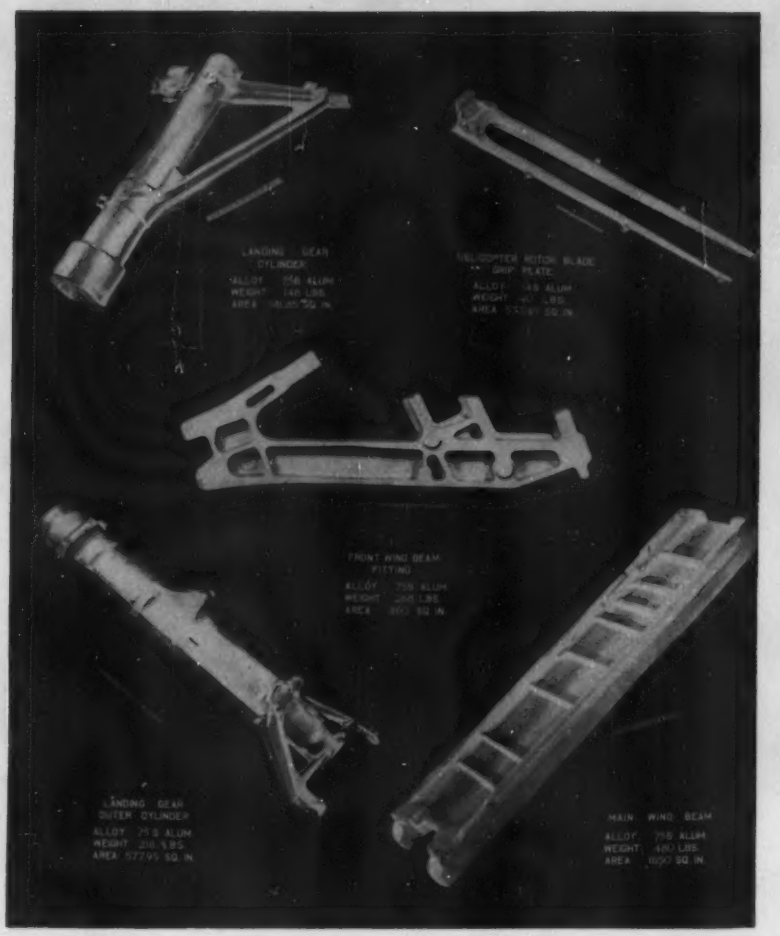
Pessimists have contended that the forging output of the heavy-press program will bog down in the machining stage. Despite the extensive installation of giant machines for profile milling, this may happen unless forgings can be produced with sufficient precision to eliminate the requirement for profile milling the entire forging.

A complex part that must be forged, then machined extensively, is potential scrap through errors in processing at any stage. If it can be forged to meet size and surface finish standards there is little chance for error once dies are right.

IMPACT EXTRUSION

The most widespread activity and interest is in a forging process that closely resembles the impact type of extrusion. The work is done in a hydraulic press, without impact, but the tooling and operating procedures are more nearly like impact extrusion than any other familiar process.

Pioneer work in this field has been done by Mc-



LARGE FORGINGS produced in 18-000-ton hydraulic press are typical of present limits. Heavier forgings will be possible when 50,000-ton presses are completed

Donnell Aircraft and Prex Forging Corp. Production parts, called "pressings," are produced in 14S and 75S alloy up to 6x10-in. area with walls as thin as 0.1 in.

Others, including Alcoa and Harvey, have begun development work on the process, producing parts in considerably larger size. Hunter Douglas, Aireserach, and Thompson Products have announced developments that are related, though not generally involving aircraft parts as yet. (See *AM*—Feb 15 '54, p184 and *AM*—May 10 '54, p172.)

Tooling is more comparable to impact extrusion than to forging. The part is entirely formed within the lower die which is likely to be a ring die fitted into a retaining ring and clamped to a bottom plate. The upper die is really a punch which may have a shaped shoulder to serve as a complete closure for the dies. Dies must be made with extreme accuracy with highly polished surfaces. Accurate slug control is essential for there may well be no provision for flash. Slugs are usually checked by weight, therefore, to close tolerances.

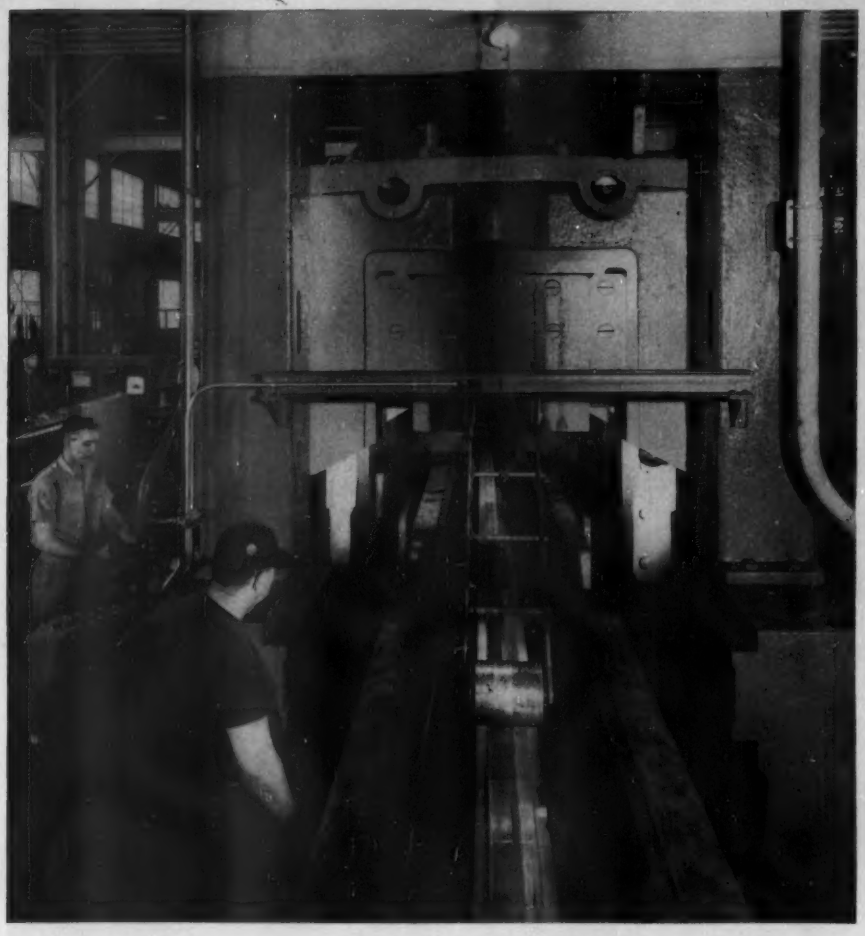
Pressures are much higher than for conventional forging in hydraulic presses as a result of the lack of draft angles and the general character of the operation. Compared with typical forging requirements of 35,000 psi, the new process takes from 50,000 psi up to as much as 100,000 psi.

Parts produced have the smooth, almost polished, appearance characteristic of extrusion. Under proper conditions, finishes run about 70 mu in. rms and finishes of 40 to 50 mu in. rms are sometimes obtained.

Some idea of the possible savings may be gained from the fact that one part at McDonnell, formerly a forging weighing 150.5 lb, required machining down to 19.4 lb. This same part has been converted to a pressing weighing 20.1 lb, which also must be machined down to 19.4 lb. This represents a reduction in the amount of chips from about 131 lb to about 11 oz.

Surprisingly, die life does not appear to be a serious problem in making aluminum and magnesium pressings. In some cases dies have produced more than a thousand parts with die wear of no more than 0.001 or 0.002 in.

Key to the entire process seems to lie in the lubrication. Information on this is limited. It is known that graphite and grease mixtures have been used in some cases and the possibility of additives (such as molybdenum disulfide) is logical.



SPAR-CAP EXTRUSION emerging from 14,000-ton press, first unit of heavy-press program to be completed

Most of the work has been limited to relatively small sizes, though parts two or three feet long are beginning to appear. Obviously the work is advancing rapidly through the available press sizes and proponents of the process are talking of the possibilities in utilizing some of the capacity of the heavy presses now being built.

EXTRUSION

With the recent completion of the first of the large extrusion presses included in the heavy-press program (*AM*—Jun 7 '54, p173), the 14,000-ton Alcoa press at Lafayette, Ind, extrusion can be extended into a new range of sizes.

Spar caps of heavier design have been showing up for some time, but their size and length were limited by press capacity. New limits are 110-ft length, 2500 lb. Stepped extrusions will reduce the machining time on sharply tapering spars.

One-piece spars (caps at both edges of a web to fit top and bottom wing surfaces) can now be extruded for the relatively thin wings of many aircraft. They replace two spar caps and a web that must now be produced separately and riveted.

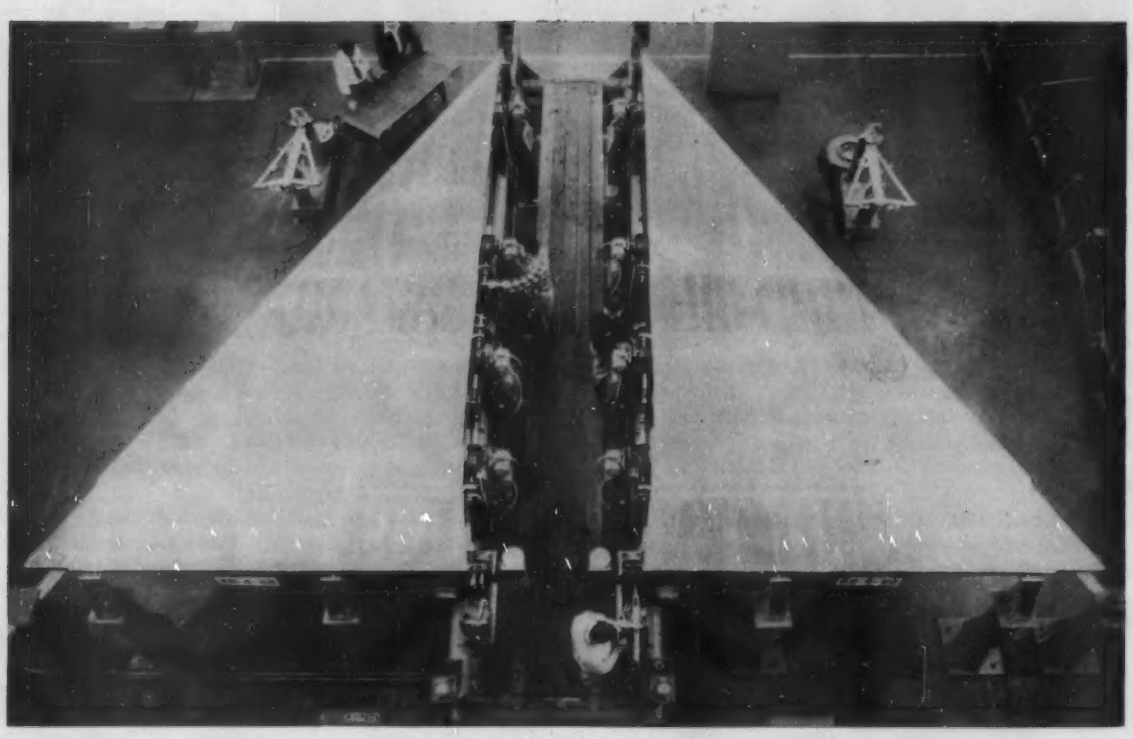
Attempts to extrude integrally stiffened skin have taken several forms: flat, round, horseshoe, and V-shape. The flat extrusion would be best except for its limited size (even in a 14,000-ton press). The other types have all been extruded successfully, but the problem of flattening has prevented acceptance. The V-shape has been most successful with its single sharp bend located between ribs. With the new press, skins 34 in. wide can be extruded in a V.

A steel beam 6 ft long with 4-in. web, two 2-in. flanges on one side and a single 2-in. flange on the other, is extruded from SAE 4340. By extruding individually rather than cutting to length from a long beam, and with a split die the stub end is left attached to the extrusion. This stub is machined to form the attachment portion of the beam. The extrusion is machined all over, then hardened to 180 to 200,000 psi. To prevent warpage, it was found necessary to heat-treat in a salt bath.

Flap tracks for Northrop and radome attachments for Lockheed are among the steel extrusions produced by Harvey (*AM*—Apr 12 '54, p256). Larger equipment will have little effect on extrusion of steel because pressure requirements are lower than for the light metals. Speed is essential to prevent freezing of the steel billet in die or container.

Assembly . . .

CLOSE FIT OF SKIN SECTIONS is gained by sawing skin off after it has been riveted to stringers. This Boeing-developed saw has four carbide teeth operating at 16,000 rpm, operates on a track clamped to work. Blade is adjusted to leave 0.0002 in. of skin uncut to avoid cutting into stringers. Teeth are adjusted so feather edge comes off with scrap piece



DRILL JIG HOLDS DELTA WING OF SUPERSONIC INTERCEPTOR TO BORE 28 MOUNTING HOLES TO 0.001-IN. TOLERANCE

DELTA WING . . .

. . . OF SUPERSONIC F102 INTERCEPTOR must be attached to fuselage without carry-through forgings. Spars are forgings machined down to 76 lb with two holes in base of each that are bolted to fuselage. The 28 holes are bored and reamed in fixture above at Convair Plant II, San Diego, to tolerance required to join the wing to fuselage with full-size holes

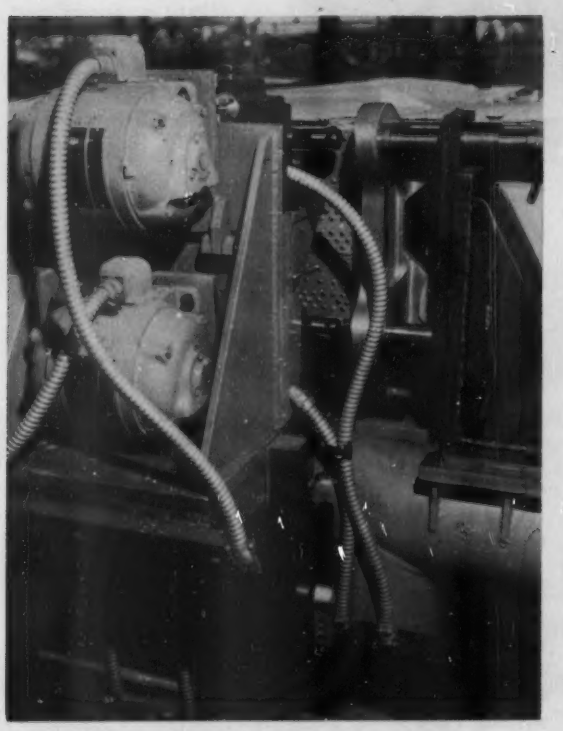
The assembly jig is developing into a precision structure that becomes virtually a machine tool. Jigs are more massive, both because they are larger and because greater precision is needed. Boeing has a concrete block as the heart of the B52 tail jig for rigidity and economy. To avoid uneven expansion of jig and work with temperature changes, heavy aluminum beams are in all jigs.

Assembly operations are carefully planned and jigs often designed to incorporate machines and tools required for operations during assembly. Optical tooling is standard practice, as it has been for some time, but methods have been streamlined. With collimators mounted on the jig itself, for example, Douglas has eliminated the original space-consuming transit methods.

By building cantilevered scaffolding, Boeing has eliminated uprights that interfere with work on lower sections of the assembly. At Douglas Long Beach an aluminum honeycomb (Aircomb) developed originally as a building material is reducing weight in flooring on large scaffolding and at the same time reducing the fire hazard from wooden flooring.

A continuing problem is the protection of skin surfaces from damage in handling. Tendency on the supersonic planes, where even minor scratches become serious, is to start at the rolling mill with papered stock (that is, a piece of paper is placed between sheets of aluminum in the stack) and continue the practice of papering through preliminary fabrication. As parts reach the sub-assembly stage, they are coated with strippable plastic. Beyond this, major reliance is on continual training of employees in the importance of careful handling to avoid damage to parts.

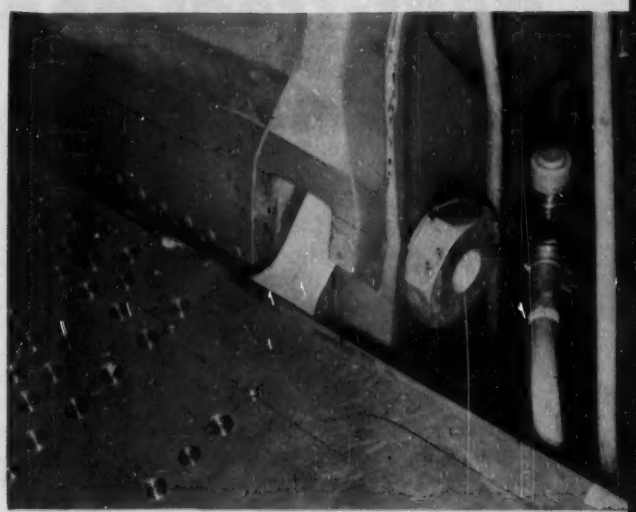
Despite the trend toward integrally stiffened skins, rivets are still a major factor in assembly of aircraft. Latest step to speed this is the General Drivematic riveter. Early models provided an automatic cycle to drill, countersink, rivet, and polish. Latest variation includes a table to mount a complete skin section and stiffeners. Table position is indexed and riveting cycle initiated automatically by punched 35-mm film control. At Convair Plant II, San Diego, this machine rivets an entire wing section in 90 min that previously required 9.5 hr. Setup of the machine is easily changed by changing film.



LOCATING PINS ARE REMOVED FROM HOLES JUST PRIOR TO BORING WITH HYDROBORES MOUNTED ON FIXTURE

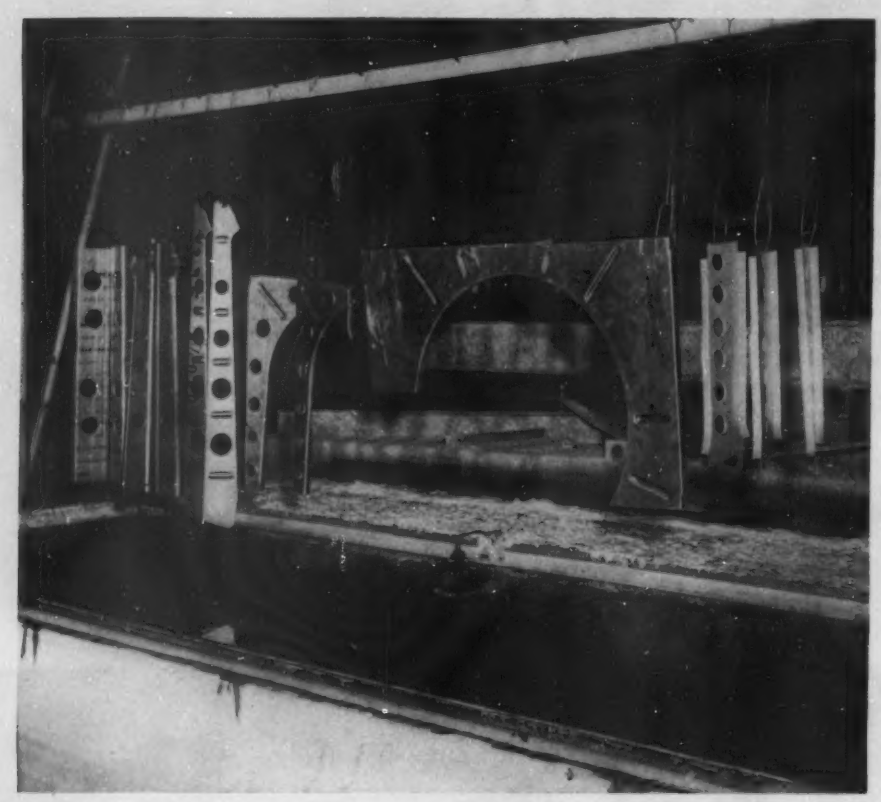
Really a special machine, fixture has individual Hydrobore unit to bore and ream each hole. Wings are mounted with locating pins fitted into each drilled hole. Stepped pin is removed for boring and reaming, then replaced in hole to locate on larger step. Torque-resistant frame of fixture (developed by Convair and built by Hardman Tool & Engrg) is built of 12-in.-dia tubing, rests on three posts

BOLT-PULLER FOR ASSEMBLY OF WINGS TO FUSELAGE



WING IS MATED TO FUSELAGE WITHOUT HAMMERING

Wings are attached to fuselage by bolts only 0.001 in. undersize, pulled into place with bolt extension slightly smaller than bolt. Shoulder block, washer, and nut on extension draw bolt into position without hammering. Only change from previous design was in diameter of threads on wing bolt to permit fitting of the shoulder block and extension



FREE-FALL QUENCH process at Martin. Parts are suspended from hangers attached to pipe rack that can be moved from tank to tank. After heating in neutral salt bath they are shifted to position over cold-water tank. Rotating pipe releases hangers, permits free fall of parts into quench. Basket, previously placed in tank, is raised to remove parts

Heat-treatment . . .

Distortion in heat-treatment of 75S has become a serious problem as parts have become larger and more complex. Unless 75S can be uniformly quenched a certain amount of distortion appears inevitable.

The drop-quench furnace is the present approach of several companies. Overhead furnaces with bottom doors to handle large skin sections (in one case 40 ft long) are installed above a quench tank sunk in the floor. Work is lifted into the furnace by hydraulic jacks, after heating is lowered rapidly from furnace to tank. At best, immersion requires several seconds and in that time the water temperature can change considerably.

Martin Aircraft has a variation in which parts are literally dropped into the tank, thus probably achieving the maximum speed of entry, but the method is applied to small and medium-sized parts, not to large sculptured skins.

Another approach for small parts of unequal section that were distorting badly has been adopted by McDonnell. Parts are hung on racks, then quenched in boiling water.

In North American's die-quench process (*AM*—Jul 7 '52, p125) the heated blank is pressed between cold matched-metal dies, formed and quenched by the cooling action of the dies. A variation of this, also developed at North American, is felt to be the most promising present process by a number of companies using or contemplating integrally stiffened skins. The lower die is replaced by a container of fine metal shot that can adjust to the part shape, still provide the cooling effect of cold metal. Wing grids 2 or 3 in. thick and 72x144 in. have been quenched in this way. Where so much heat is to be removed, heavy water-jet cooling of the dies is necessary.

None of these methods is ideal. What is basically required is to hit every side of every section of the skin simultaneously with water. In theory spray could come closest to this, but the cooling effect of spray is inadequate for heavy sections. Engineers are still working on this problem and other approaches are being developed.

In treating steel weldments for engine mounting, Rohr employs rigid steel fixtures coated with temperature-resistant paint. One set of fixtures is provided for stress relieving and another set for tempering. For hardening, the assemblies are heated in one salt bath, quenched in another salt bath, to avoid distortion.

Round Table

Patent Pay

"What ever happened to the patent your man Larson was going to take out on the new die feed he rigged up, Ed?"

"Oh, I guess the company lawyer is still working on it. They have to run a patent search and a lot of other stuff before they can actually issue a patent."

"How come the company lawyer is doing it? I didn't think the company was supposed to provide *that* service for employees."

"It's not for the employee, Al; it's for the company. Who did you think was going to get the patent, Larson himself?"

"Well, sure. Why not?"

"Look, Al. There's a couple of good reasons why not. In the first place, Larson rigged up the feed on company time, with company materials and money, and with company permission. And on top of that, he turned it in as a suggestion and got his award check. That's assigning a patent if I ever heard of it."

"What does Larson say about that, Ed?"

"Well, I talked to him and got him straightened out."

"You mean you talked him out of it, Ed. Why can't the company give him the patent? After all, it's just a small gimmick, and he'd probably assign it free to the company anyhow."

"Maybe he would, and maybe he wouldn't, Al. The point is that he made the idea work on company time, with company money. He was paid for the idea with the suggestion-award check. That clears the deal."

"It sure doesn't give him much for his idea — you will admit that it was his idea, won't you?"

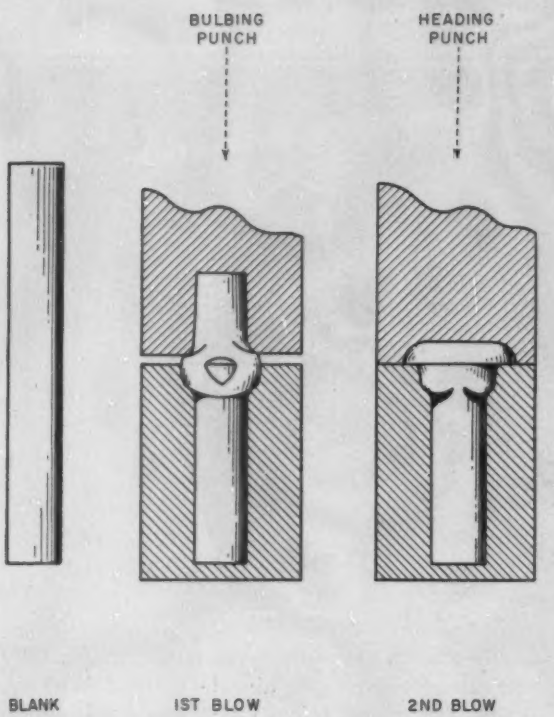
"Sure, it was his idea, Al."

"Then I think he should get something more for it — something more lasting. That award check will go quick, but income from a patent would probably keep rolling in."

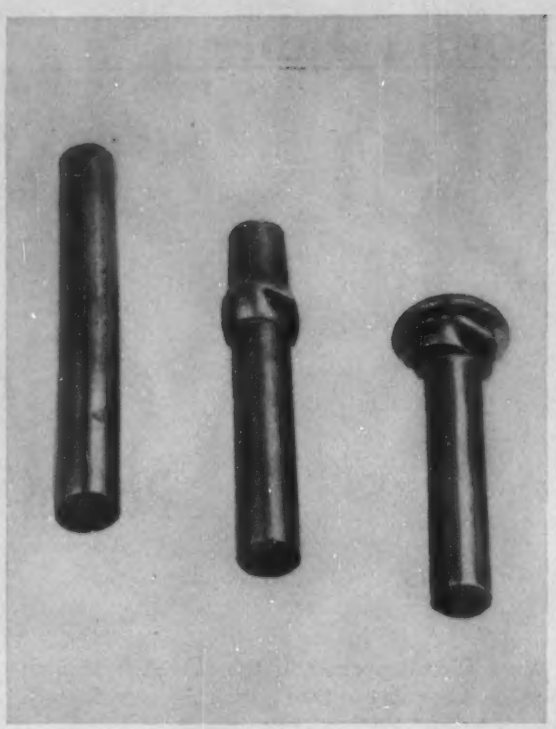
"Al, if he had thought up the idea and worked it out himself in his own home, which has been done, I'd agree with you — except that he turned the idea in on suggestion plan. That's about the same as making it public domain, as far as I can see, so he's really given up all patent rights."

"Just because he's not a legal expert, you're going to penalize him, is that it?"

***SHOULD LARSON HAVE** been advised by the company to take out a patent, or did the company already own the idea because it was worked out in the plant? Your ideas on the subject may help others. Discussions of earlier topics appear on later pages.*



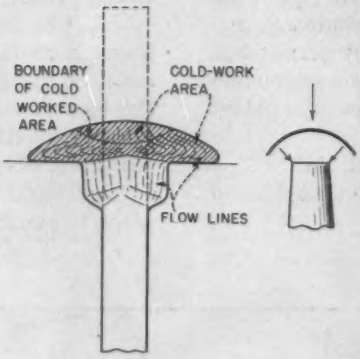
BULBING AND HEADING are steps in producing bolts for electrical connectors. Bulbing starts the metal moving and must be accomplished without eccentric flow which will lead to defective bolt. Without bulbing operation, wire might collapse under heading punch when finished bolt head is formed. Shown above are steps in forming new pan head bolt

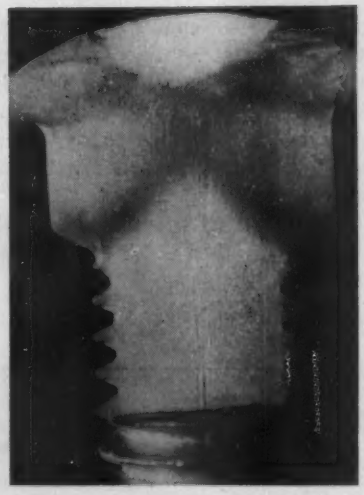


Production methods are key to

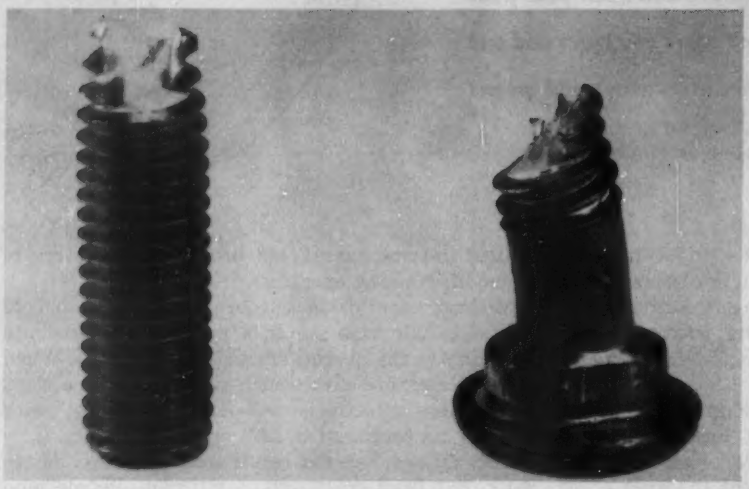
MORRIS BRENNER
Associate technical service engineer,
BURNDY ENGINEERING CO, INC,
NORWALK, CONN

Silicon-bronze bolts for mechanical types of electrical connectors are a feature of reliable connectors. A redesigned bolt head developed from study of production methods adds material to the head and moves the center of coldwork up in the head. Result is a better bolt that is easier to produce



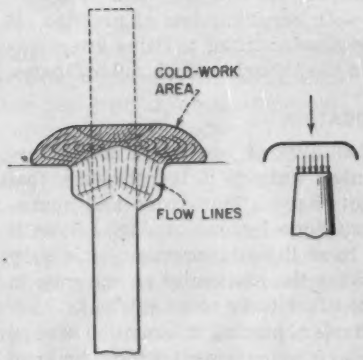


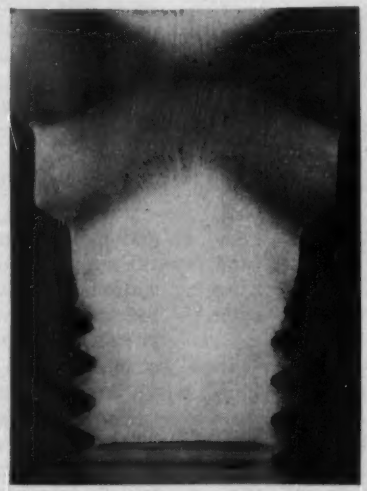
OLD DESIGN—round head, oval shank
Area of heavy coldwork in head of bolt is centered almost on the base line of the head. Heading punch hits the corners of the wire and if either wire or die is slightly off center, causing an eccentric hit, the metal will not flow uniformly



WEDGE TEST reveals weakness in head. Bolt is placed in 15° wedge and pulled to destruction. To pass the test, bolts must always fail in the shank with no evidence of parting between head and shank

improved bolt design



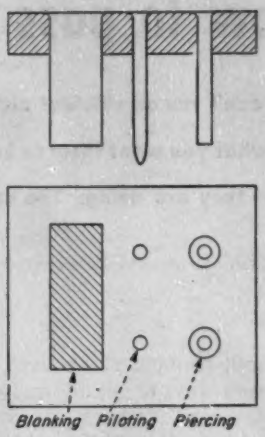


NEW DESIGN—pan head, oval shank

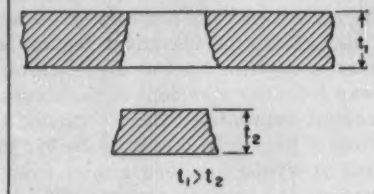
Larger volume of material permits lighter coldwork in forming the head. Area of heaviest work is centered well above the base line, adding to strength of head. When heading punch hits wire, all forces are normal to the top, reducing danger of non-uniform flow

Diemakers' Kinks

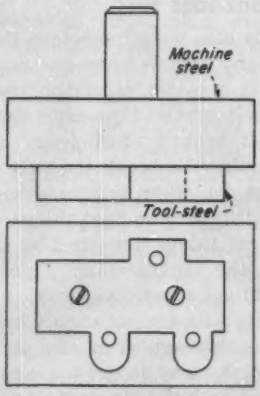
FEDERICO STRASSER



AN IDLE STATION between piercing and blanking stations is advisable in small progressive dies. If the pierced holes are comparatively large, they can be used for indirect piloting.

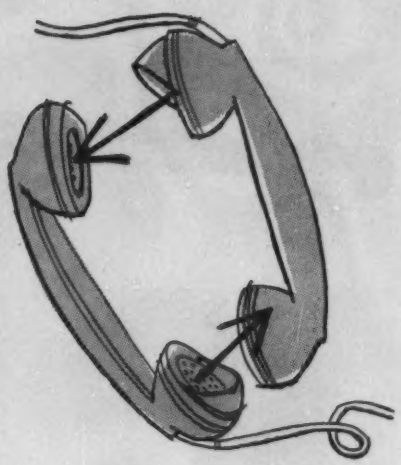


BLANKS made from thick stock are thinner than the original metal. Take this into account when blanks of predetermined thickness are required.



LARGE BLANKING punches can be made in sections to save expensive steel and simplify diemaking. These punch parts are fastened to a machine-steel punch holder with screws and dowels.

How to pass the word



You can't run an efficient plant when you can't tell your people what you want them to know, and when you can't find out what they are doing. The author discusses ways and means

THEODORE A JACKSON, PhD, STEVENSON, JORDAN, & HARRISON, INC

Smooth-running plants can't be had without quick and sure ways to get information from one person to another, and systems of getting this information can't be made without understanding what problems tend to get in the way of accurate exchange of information.

There are three directions of communication between people in a manufacturing organization: down-the-line, up-the-line, and lateral.

Down-the-line communication means the kind of orders issued from someone in authority to subordinates. This kind of communication takes for granted that a definite line of organization exists, all the way from the president of the company down to the newest apprentice. Orders cannot be passed along from a person in authority to his subordinates unless everyone involved knows exactly who his superiors and subordinates are. This is the first rule in communication setup.

What is just as important, once these channels have been established, they must be used—frequently and without exception.

THE ONE-BOSS RULE

It is also very important that each person in the company should have *one boss, and only one boss.* This is a pretty commonplace idea, but experience shows it broken time after time, and every time the rule is broken, inefficiency and antagonism arise.

People who break the rule always have a "good" reason for their actions—they're usually the "go-getter" type who "get things done in a hurry," and who get things done fast at the expense of tearing down the organization. This is a pretty expensive way to get something done.

A good supervisor should keep one thing clearly in mind—although it is nice to get things done in a hurry, the way to get the most done in the shortest time is to build an organization where things will be done with a minimum of personal attention. This is done by creating channels of authority and using these channels, building a sense of responsibility all through the line organization, so subordinates can learn the feeling and skills of exercising authority, limited to some extent, but broad enough to create a smooth-running operation.

Modern supervision encourages participation of all the people who are in a position to contribute anything to the overall efficiency of a plant. When subordinates are given such chances, they always work more effectively and enthusiastically, with marked improvement in skill and productivity.

This change does not result from harder or faster work, but from an improved attitude. People who are given such a chance to expand find they have released a wellspring of resourcefulness and thoughtfulness which had been sealed up until such a chance came.

UP-THE-LINE COMMUNICATION

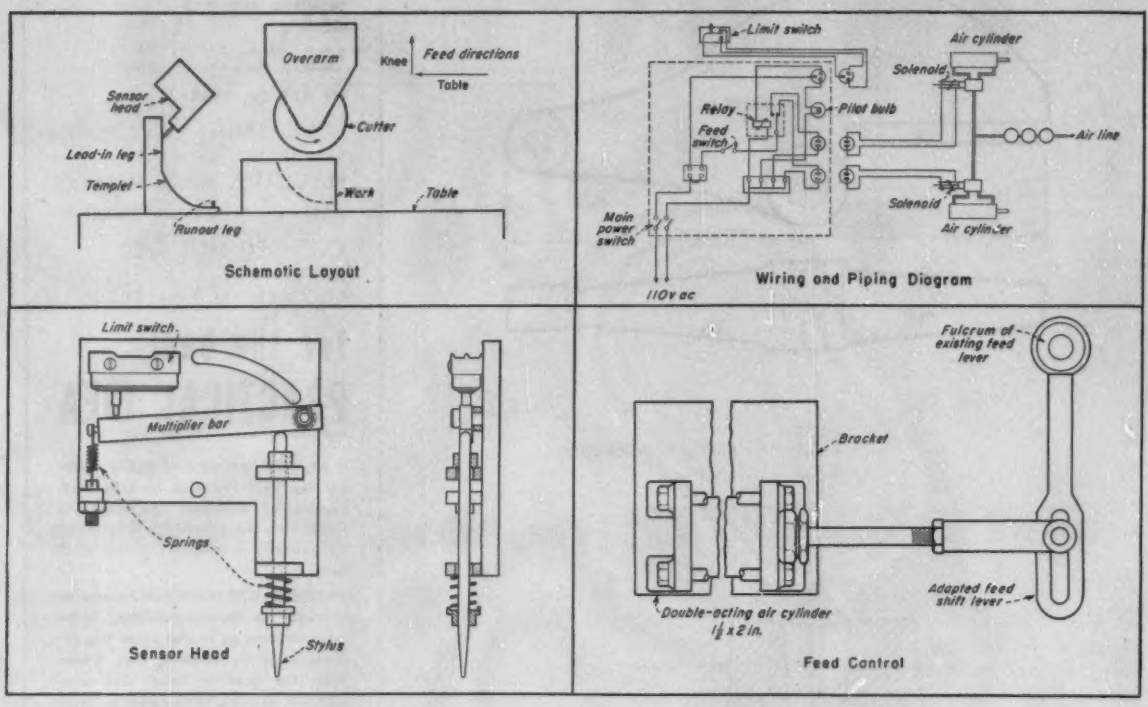
With such a potential source of information and help, it just isn't sensible not to make every effort to listen to and give full consideration to the ideas of subordinates. In the world of today's manufacturing, it often happens that a subordinate knows how to do some jobs which his superior does not know how to do. Yet many supervisors are afraid to encourage up-the-line communication, for fear they will be shown up in some way, with resultant loss of prestige. It takes a pretty good administrator to listen attentively, without fear, to the thoughts of his subordinates.

LATERAL COMMUNICATION

For greater flexibility of operation, for higher and more economical output, it is necessary that various departments have a knowledge and appreciation of the work done by one another. Even if two departments have little in common, it is very possible that knowing the economies of one may in some way help the other to be more efficient.

These three methods of passing information around are all interrelated. A management which, by good down-the-line communication, develops and maintains an atmosphere of understanding and loyalty will be rewarded by a spontaneous flow of up-the-line suggestions and ideas which can be passed around laterally for the good of the entire organization.

But it is up to management to make the first move.



Simple Contour-Milling Attachment

This simple contour attachment is designed to mill contours to about ± 1/64 in. Total cost is about $125.00, which the use of the device paid for in a short time. The attachment is readily installed or removed from the milling machine.

The principle of the attachment is similar to that of contour milling by hand and eye, alternately stepping the contour by selecting appropriate feed direction. The device shown here eliminates the need for following a contour "by hand."

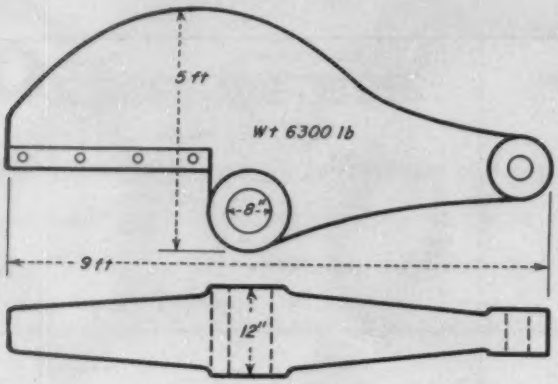
The part of the attachment which replaces the operator's eye, when following a contour, is a stylus linked to a multiplier bar which contacts a precision limit switch. The limit switch is connected to solenoids which control air cylinders, putting knee and table feeds on or off alternately, depending on whether the stylus, acting through the multiplier bar, has opened or closed the limit switch.

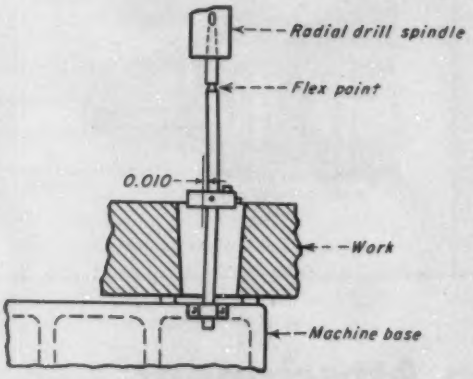
The multiplier bar amplifies movement of the stylus, in this case 8:1 multiplication, so that to operate a switch requiring 0.002 in. travel, the stylus must move only 0.00025 in. Two springs relieve the pressure on the limit switch when the stylus moves away. Usually only one of these springs is needed, but if the templet is rough, causing the stylus to bounce at high speeds and feeds, the auxiliary spring acts as a damper. Spring tension should be adjusted to just counteract the weight of the multiplier bar, to overcome any sticking.

In case of power failure, the device is designed to return all controls to neutral. Therefore, in case of trouble, it is necessary only to open the main power switch to stop tracking the templet.

The most satisfactory templet material, being cheap and easily worked, is tempered Masonite. Be sure, when laying out the templet shape, to correct the templet for cutter radius. Also, lead-in and lead-out legs on the templet serve to start the cutter in correct position with respect to the work, and to take the cutter away from the work at the end of the cut.

In operation, the work is placed on the machine table, and the cutter moved to correct starting position. When the main power switch is turned on, the pilot bulb will light up. Move the templet against the sensor head until the pilot bulb goes out, and clamp the templet in place. Turn on the air supply, start the machine table, and turn on the feed switch. The knee should begin to feed upward. When the stylus touches the elliptical part of the curve, knee and table feeds will alternate to cut the required shape. When the cut is finished, turn off the feed switch and return the cutter to starting position with hand cranks. Correct position is indicated when the light goes out. *C B Weidner, Allentown, Penna*





Flexible Tool Support Aids Cutting Tapered Hole

We run a job-shop in which we do industrial maintenance and repair. Because we handle this kind of work, we often have to do unusual improvising to get some jobs finished in a hurry.

One such job called for machining a tapered hole in a large casting (5 x 9 ft) which weighed more than 3 tons. The bore was the shaft hole of a large shearing machine.

Because there is no boring mill in our shop which is large enough for the job, and the customer was in a hurry to get the work done, we improvised the setup shown.

One of our large radial drills had been equipped with a guide bearing to support the bottom end of boring bars, so we used this method to bore the hole:

Work was positioned over the guide bearing, and centered, leveled, and securely clamped down. A long slender boring bar was provided with a cutter head to carry a toolbit. Then the bar was grooved just below the spindle nose, to allow flexing there. The bar was bent 0.010 in. on a press, so it had a 0.020-in. "runout" at the center, where the cutter was fastened. When we started the cut, there was a 0.020 in. eccentric effect at the top of the hole. As the bar was fed through the bearing at the base of the hole, the cut gradually became more concentric, as the boring bar became confined by the self-aligning ball bearing guide.

Because we were to turn a tapered shaft to fit the hole, the exact dimensions were not extremely critical. We could correct for any difference between the intended and resulting dimensions.

The method did the job quickly and well. *J W Wallace, Monroe, La*

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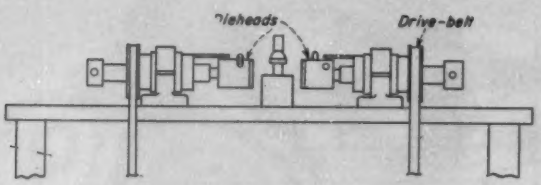
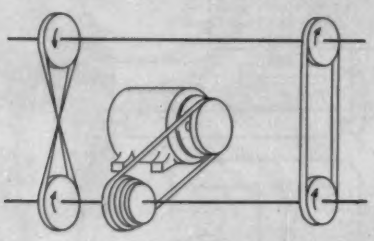
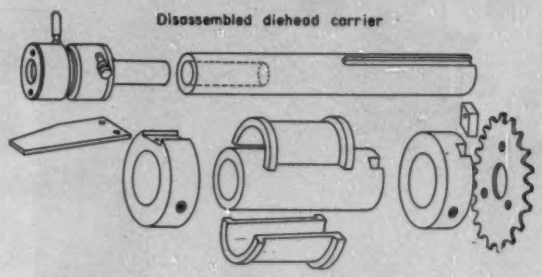
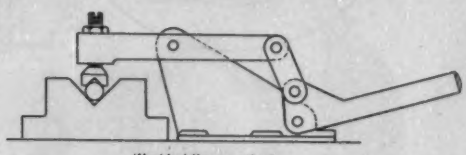




Suggested driving method





Workholding method

Self-Opening Dieheads Cut Threading Time

Studs requiring threading on both ends can be machined very quickly with this device, which is essentially two self-opening dieheads mounted on a frame, and driven by a common motor.

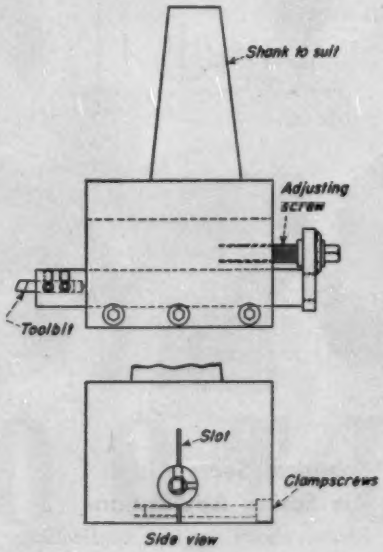
The die carrier heads consist of a standard pedestal bearing which carries a length of hollow shafting locked endways by two standard shaft collars. Through the bore of this shaft passes a bar bored at one end to take the diehead shank; the other end of this bar is keyseated for some distance. The tail collar and bearing shaft are keyslotted on the end faces, so that the key holds diehead, tail collar, and bearing shaft. The drive pulley or sprocket acts as a retainer for this assembly.

A recess, milled in the front collar, supports a finger which extends beyond the collar far enough to trip the reset lever of the diehead. The "throw" required by the reset lever establishes the amount of taper on the reset finger.

Advance and withdrawal of the dieheads are controlled by levers hinged on the bed of the machine, and engaging a running collar on the diehead bar.

There are several driving methods which can be used. First, flat belts can be driven from a common driving pulley on the end of the motor. One of these belts would be crossed, to reverse the direction of rotation. Another method might be to drive the dieheads with a motor which has a double-ended driveshaft, reversing direction of one diehead by 1-to-1 spur gearing. Dieheads could then be driven with chain and sprockets. A problem with this type of drive is that noise indicating early chaser wear might be drowned out by gear noise.

Work is held in place by V-blocks and toggle clamps. Because torque is exerted on the work in both radial directions, actual holding force is very low, and results from dies not cutting equally freely. Also, there may be a momentary torque if one diehead bites into the work before the other, because the dieheads are fed individually. *W D Arnot, Bristol, England*

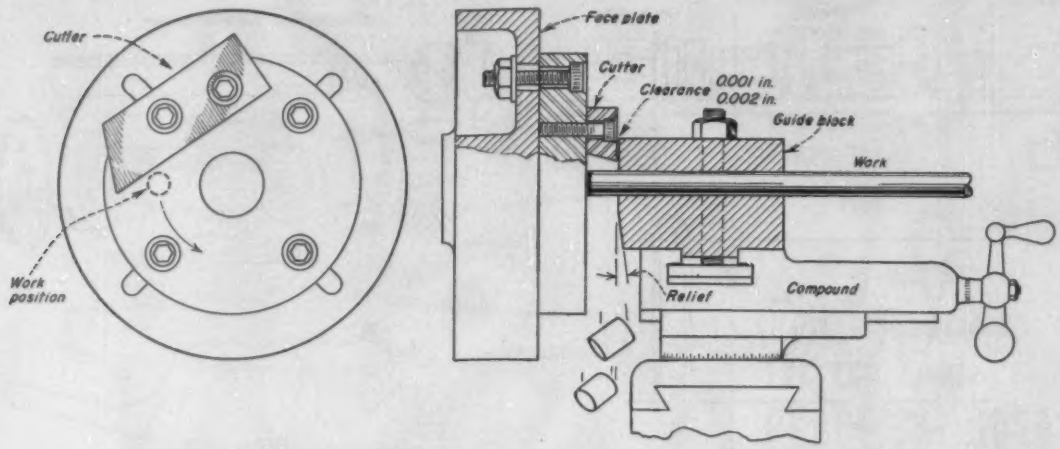


Inexpensive Boring Head

Our job shop is fairly well equipped, but there are some tools which are still a luxury for us. One of these is a large boring head. We sometimes need such a tool, so we designed and built one.

The commercial tool is usually built with a dovetail slot, but we decided we would use a round bar, which can be fitted to a carefully reamed hole.

We made several bars of different lengths. The tool feed is controlled by a feed screw. For blind holes we have an offset boring tool in the end of the bar. The body is split, as shown, to allow secure clamping. The shank is offset to clear the adjusting screw. *H Koslow, Bronx, NY*



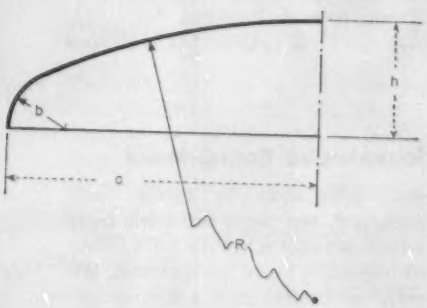
Simple Rotary Shear On Lathe

A shear blade mounted on a lathe compound gives a cheap way to cut short blanks from small round stock. To make the tool, mount a heavy steel or cast iron block on the lathe compound. A drilled and reamed hole through this block guides and supports the stock with a snug sliding fit.

A tool steel shear blade is mounted on a circular steel "stop" plate, which is bolted and doweled to a lathe face plate.

The lathe spindle is started, at rather low speed, and stock is pushed forward to hit the "stop" plate. As the shear blade passes the work, the stock is cut off. A forward movement of stock is made each time the shear blade passes the work. As the operator's skill improves, the spindle speed may be increased somewhat.

This same device may be used to cut square or rectangular stock with a correctly shaped channel. *H J Gerber, Stillwater, Okla*



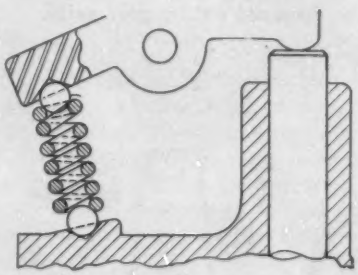
Formula For Ellipse Layout

Blending radius for ellipse layout can be found by this formula:

$$R = \frac{A^2 - 2AB + H^2}{2(H - B)}$$

For example, if A is 6 in., B is 1 in., and H is 2 in., R, using the formula, is 14 in.

I have not been able to find this formula in my handbooks. *W J Stedman, Eau Claire, Wis*

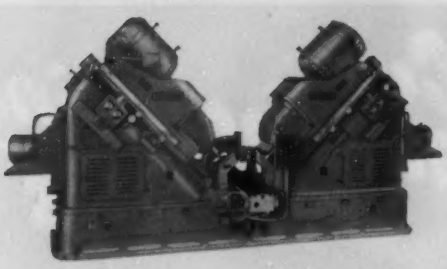


Spherical Seats Aid Die Spring Application

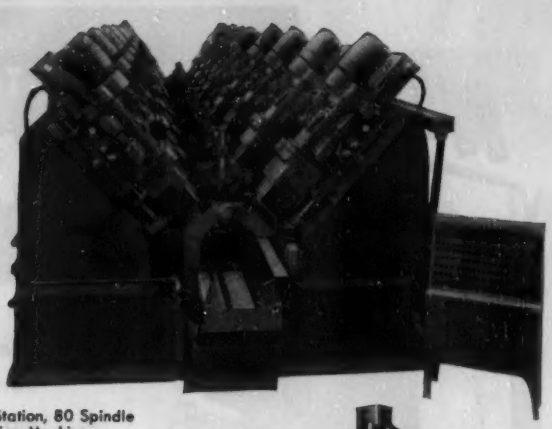
Shown above are two applications of die springs which involve a long stroke pivoting around a dowel pin. Under this condition, it is not practical to have the spring seat in a cavity in the die, because during the long stroke, the spring would become distorted as the members of the die moved.

To establish a floating seat, the spring is mounted between two ball bearings, as shown. These balls are set into drill spots, to allow the spring to float through the stroke.

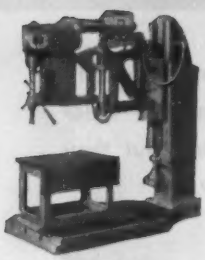
Another application has two mating members, each of which has a spherical head. Both heads are mounted in their respective drill spots. The projecting stud which slides within the other member is not needed, except to retain the spring in case the spring breaks. The same principle could, of course, be applied to any similar situation, provided the type of spring is suitable — that is, the spring must be "self-supporting." *F C Elmo, Dayton, Ohio*



Two-Way Hydraulic Feed
Vee Type Stub Boring Machine



17 Station, 80 Spindle
Drilling Machine



Unique Bracket Type Hammond
Radial Drilling and Tapping Machine

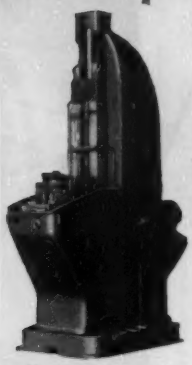
FOOTBURT

line of production machines

• Way Type Drilling, Boring, Reaming, Tapping and Milling Machines with One, Two or More Ways... Station Type Machines . . . Center Column Type Machines... Cylinder Boring Machines... Inverted Drilling Machines . . . Surface Broaching Machines . . . Sensitive Drilling Machines . . . Hammond Radial Drilling Machines . . . Manufacturing Type High Duty Drilling Machines . . . Independent Feed Drilling Machines . . . Special Machines.

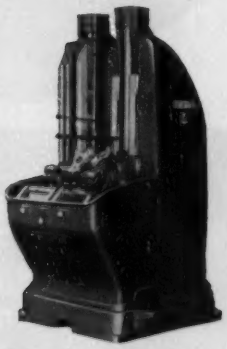
THE FOOTE-BURT COMPANY, Cleveland 8, Ohio

Detroit Office: General Motors Building

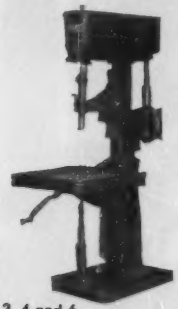


Single Slide Broaching
Machine 5, 10, 15 and 25 Ton
capacity

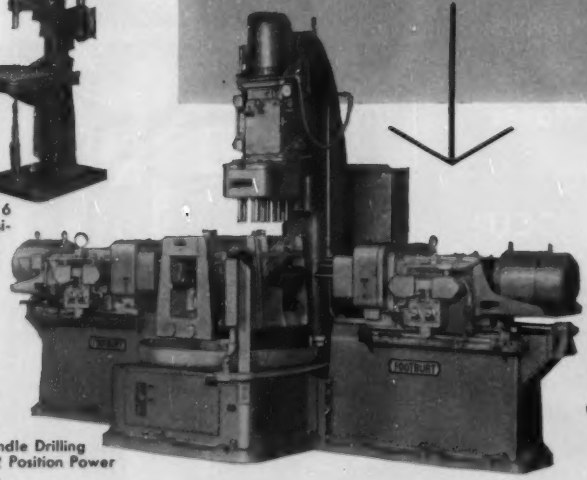
Stub Type Cylinder
Boring Machines



Duplex Surface Broaching
Machine 5, 10, 15 and 25 ton
capacity



1, 2, 3, 4 and 6
Spindle Sensi-
tive Drilling
Machines



3-Way 31 Spindle Drilling
Machine with 2 Position Power
Indexing Table

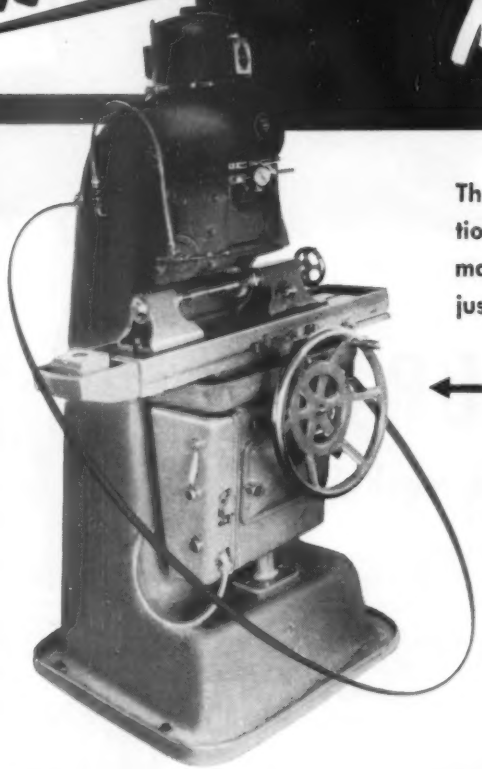
Continuous Type Broaching
Machine Built in Five Sizes

engineered for production

FOOTBURT

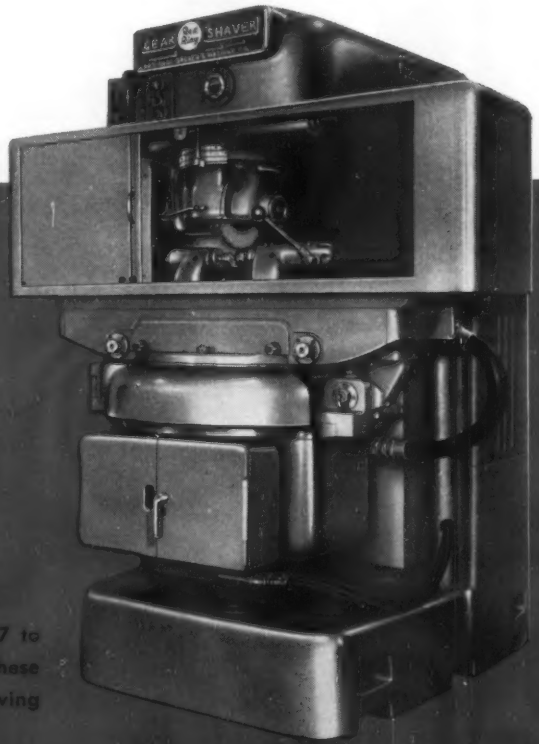
MACHINE TOOLS

NOW IS THE TIME TO Cut Manufacturing Costs



The one sure way of meeting today's competition is with today's machine tools. The older machines were all right in their day but they just haven't got what it takes now.

For instance, it took this old Red Ring Model GCC 60 seconds to shave a gear like the one shown.



Model GCU today finishes that same gear in just 16 seconds—and to much closer tolerances, too.

In an 8 hour day the GCU will deliver 375% of the production of its predecessor.

Write for Bulletin S 53-7 to get all the facts on these new cost saving gear shaving machines.

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

Reasons for Carbide-Tool Failure...IV

W L KENNICOTT, chief engineer, KENNAMETAL, INC., LATROBE, PENNA

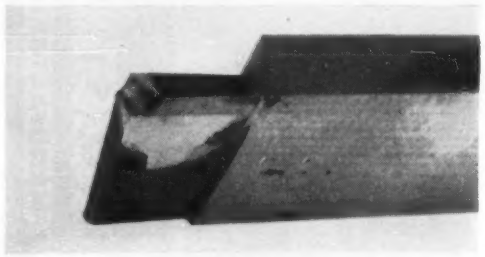
Here are more examples of tool failures, how they were analyzed and corrected.

An important concept is how tool forces act. At a well-balanced operating carbide tool, the largest force will be downward; the pressure necessary to shear and deflect the chip. A second force acts along the shank, and a third is the feed force, acting along the work axis.

Thus, the Tangential force can be rated 100; the Radial force will be about 10 to 50, and the Feed force will be from 35 to 70. Normally, a broken tool will show some evidence that these forces were unbalanced; or else the tool was crippled before being used. Examples of unbalanced forces are those due to stalling, excessive feed, extreme dullness; of crippling factors are grinding cracks, heat checks, unsuitable tool geometry, and improper grade selection.

Broken after regrind ...

PROBLEM	SOLUTION	CORRECTION
Reground inserts for heavy-duty clamped boring mill tool broke frequently	Smashed bits could not be checked. New regrinds showed heat checks on side flank and fixed-feed silicon-carbide grinding (faulty preparation)	New grinding fixture to produce proper angles while offhand grinding with table set at 0° was built. Crazing stopped



Broken grooving tip ...

PROBLEM	SOLUTION	CORRECTION
Tipped grooving tools in one lot broke excessively; older lots had worked OK	Surface-ground shank side showed longitudinal marks; pass of grinder also hit tips, ruining relief for about 1/16 in. (faulty preparation)	Shank-side grinding was done across shanks, preventing damage to tips and clearing up difficulty

Land wear ...

PROBLEM	SOLUTION	CORRECTION
Form-tool inserts for cutting forgings showed localized land wear suddenly	Top bulge indicated carbide had mushed. Land 0.015 in. wide at 45° on edge had been ground by machine—came out 1/16 in. wide (faulty preparation)	Process was returned to hand honing to produce the land. Chip no longer piled up to cause high pressure and temperature

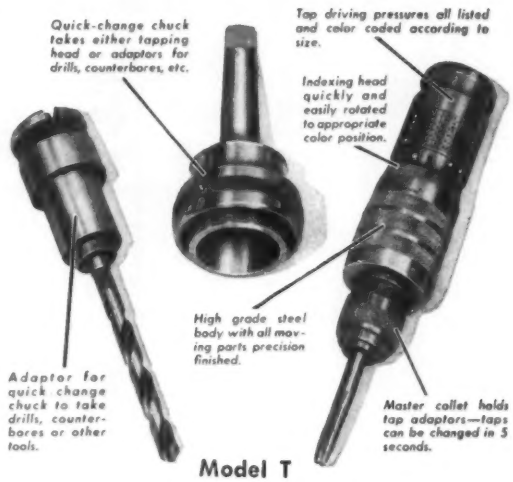
WICKMAN TAPPING ATTACHMENTS
Instant Pre-Selection of Tapping Torques

Pre-selected tapping torques are instantly obtained by presetting the pressure on a two tooth clutch to the required tap size. This is done by means of a highly resilient pressure unit which allows the clutch to slip when tap is overloaded.

WICKMAN HIGH SPEED TAPPING ATTACHMENTS (Model K) are furnished with Morse Taper Shank attached as an integral unit. Special shanks are furnished on request.

WICKMAN COMBINATION TAPPING ATTACHMENTS (Model T) are designed to fit readily into or be removed from their quick-change chuck even while machine spindle is running. Wickman adaptors for holding drills, counterbores or any other tooling required for your operation can be inserted in the same chuck.

Models K & T sizes and range: from 3/16" to 1 3/4".


Quick-change chuck takes either tapping head or adaptors for drills, counterbores, etc.
Tap driving pressures all listed and color coded according to size.
Indexing head quickly and easily rotated to appropriate color position.
High grade steel body with all moving parts precision finished.
Adaptor for quick change chuck to take drills, counterbores or other tools.
Master collet holds tap adaptors—taps can be changed in 5 seconds.

Model T

Model TS

WICKMAN TAPPING ATTACHMENTS FOR TURRET LATHES (Model TS) are considerably shorter than Models K & T. They also permit presetting of tapping torque required for any tap size or material, thus preventing tap breakage in blind hole tapping or materials difficult to tap.

Model TS sizes and range: from 3/16" to 1".

WICKMAN-BROWN ADJUSTABLE FLOATING REAMERS

Equipped with fully floating blades and direct reading micrometer adjustment, Wickman-Brown Reamers do not require special tools for setting. Reamers may be operated rotating or stationary and are furnished with either high speed or carbide tipped blades.

Wickman-Brown Reamers assure absolute accuracy, complete concentricity and superfine surface finish on both through and blind hole reaming.

Sizes range from 3/4" to 4"

Model SL

For further information concerning Tapping Attachments or Reamers send for your copy of descriptive literature.

THE Wickman MANUFACTURING CO.
10325 CAPITAL AVENUE
OAK PARK (Detroit 37), MICH.

Reasons for Carbide-Tool Failure...V

Chipped edge ...

PROBLEM

Square inserts chipped along cutting edges almost immediately after cut started

SOLUTION

Fractures under end surfaces showed under glass. Cause was clamping bits in overlapping steel jaws of vise (faulty preparation)

CORRECTION

Collet holder was provided to grip bits while grinding so pressure cracks could not develop

Spalled tip ...

PROBLEM

Insert for facing shell to centerline frequently spalled at tip

SOLUTION

Spall showed excessive side pressure, which could occur only if tool was above center (faulty application)

CORRECTION

Tools were reset accurately to center height to end flaking action

Broken tip ...

PROBLEM

Unused carbide tool had large section broken from tip

SOLUTION

Lack of marks on tool would indicate sharp blow was cause of damage (faulty handling)

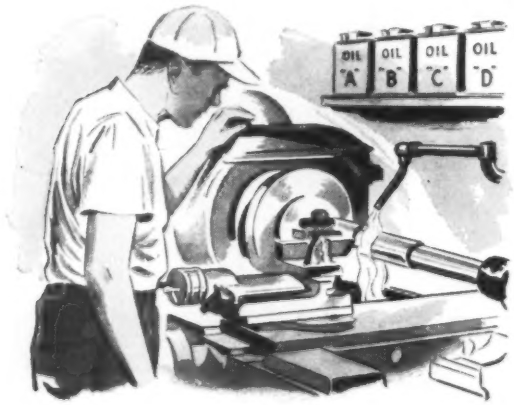
CORRECTION

Partitioned wooden boxes, employee training reduced handling damage

How to Pick the Right Cutting Oil

WORD OF MOUTH?
It gives you the answer sometimes, but not many of your friends have the same cutting oil requirements and the same problems that you have. It's much surer to depend on specialists like Sun.

LABORATORY ANALYSIS?
Sure. But there's no formula for correlating the laboratory analysis with how well the cutting oil will work on your job. It takes years of field experience like Sun's to help you make the right choice.



ELABORATE SHOP TEST?
This will probably give you the answer. But it's expensive and interferes with production when you try to test all the oils available. Sun's experience can help keep your shop-testing to a minimum.

EXPERIENCE IS THE ANSWER.
And Sun has it. Its field representatives have probably come across problems similar to yours many times. If they haven't, its cutting oil specialists and metallurgical technicians are ready to help with your problem.

Soluble or straight, transparent or black, light or heavy duty — Sun makes the kind of cutting oil you need to handle your job at the lowest cost. For more information, call your nearest Sun office or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. AM-7.

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

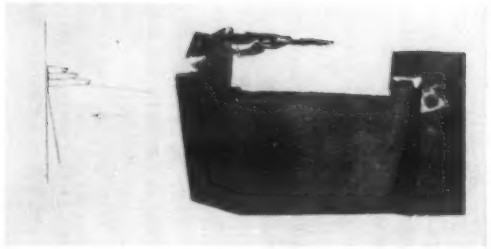
SUNOCO®

PHILADELPHIA 3, PA. • SUN OIL COMPANY LTD., TORONTO & MONTREAL

Refiners of famous High-Test Blue Sunoco Gasoline

Reasons for Carbide-Tool Failure... VI

Shattered tip ...



PROBLEM

Shattered tip on turret-lathe tool showed laminations as if pressed hard against plane surface

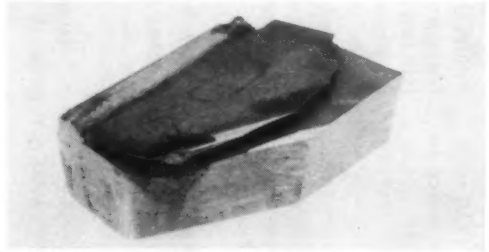
SOLUTION

Turret-lathe cycle would allow turret to feed tool against side of cross-slide toolpost (faulty application)

CORRECTION

Machine was recycled to make misfeeding impossible, even if operation did lag a few seconds

Broken planer tool ...



PROBLEM

Infrequent failure of large planer tool was expensive; damaged toolholder

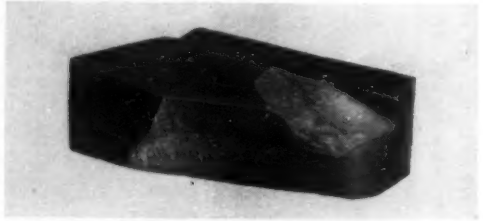
SOLUTION

Flake, reset in tip, would not slide, but would lift; indicating sharp blow not from cutting action. Clapper box found defective (faulty equipment)

CORRECTION

Clapper-box lift repaired to eliminate the trouble

Broken nose ...



PROBLEM

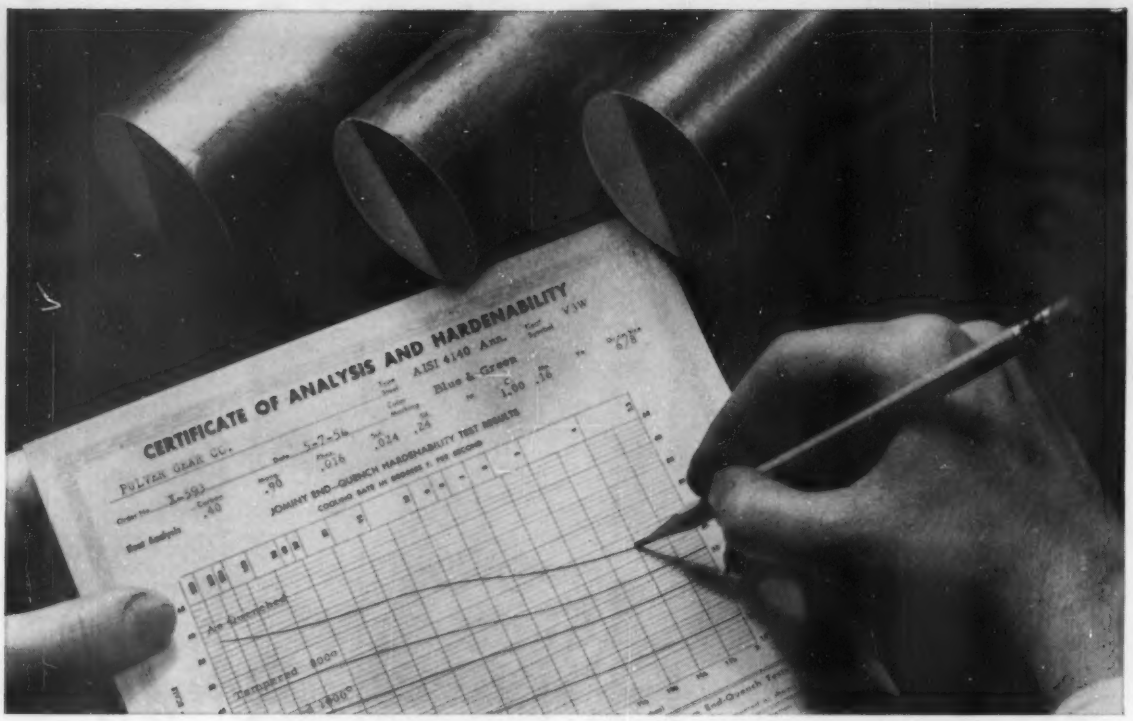
Insert for boring-mill tool destroyed at nose. Spall would move only up and back

SOLUTION

Normal cutting forces could not cause damage; but power interruption would unbalance tool-tip forces. Recorder showed power failure at time damage happened (malfunction of equipment)

CORRECTION

No correction needed because power failures are infrequent



Steel user drops own tests

relies on pre-tested Ryerson alloys

A manufacturer reports that it was standard practice with his company to run a pilot hardenability test on all alloys, regardless of source. But after checking their results over a period of time against Ryerson Certificates of Analysis and Hardenability, they decided that our alloy steel and our Certificates were so completely reliable that the pilot run could be discontinued. The result: a definite saving in time and money.

* * * *

You don't have to run analysis or heat treatment response tests on Ryerson Certified Alloys. You save time and money because these tests are run and recorded for you as a part of the exclusive Ryerson 8-step quality control plan.

Starting with the careful selection and identification of every heat carried in Ryerson stock, this plan assures you of quality steel—steel of known analysis and known performance. It means that tested alloys, racked separately by heats, are accurately prepared to your specification and shipped to you with test data to confirm quality and guide heat treatment.

Yes, you save time and money with Ryerson Certified Alloys . . . yet you pay no more. To get these dependable controlled-quality steels promply, call your nearby Ryerson plant.

RYERSON STEEL

Principal products in stock: bars, structurals, plates, sheets, tubing, alloy and stainless steel, reinforcing steel, etc., also machinery and tools.

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • PHILADELPHIA • CHARLOTTE, N. C. • CINCINNATI • CLEVELAND DETROIT • PITTSBURGH • BUFFALO • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • SPOKANE • SEATTLE

Talking Shop . . .

Radiated Caterpillar

CATERPILLAR TRACTOR is beginning research with radioactive materials. Oak Ridge has radiated two test rollers for a roller test machine used in studying gear problems. Rollers weigh about a pound apiece, but are shipped in a 1300-lb lead container.

"Fleximation"

AUTOMOTIVE-ACCESSORY MEN, who have been studying automation and attempting to apply it, too, are coming up with a new word—"Fleximation"—to mean the ability to produce a flexible, automated line. This means that the line must be readily changeable to suit design changes in the product. Further, tooling must be of quickly interchangeable units that must be quickly replaceable. Lines will be designed for optimum size, and where production requirements are greater, then those lines will be duplicated or triplicated. Also breakdowns, maintenance stops, or design changes may be provided for with a standby line. This line might also handle another size or another product for which demand is not so great. The basic idea is to have the "jump" line ready and waiting so that when an automated line goes down the operators simply shift to the other one and keep on working. That maintains employment and utilizes labor effectively. Such an idea would not have been economical a few years ago, but now labor costs so much in proportion to the cost of equipment that it is apparently economical to have machines standing by. One figure that has been mentioned is that any machine tool that can work three days a week is an economical investment.

Suggestion Payoff

IN MANY PLANTS the suggestion program is an established institution offering cash as incentive for cost-saving ideas, but we recently heard of an idea that paid off in more than cash at the Long Beach Div of Douglas Aircraft. The tooling supervisor, who sits on the suggestion committee, noted that one proposal for a fixture from a man in the shop was so well organized, so clearly thought out, and so neatly drawn, that he looked up the suggestor. Turned out to be a Mexican boy (a legal emigrant, not a wetback). He offered the youngster a job in the tooling department. Today, as a result of that suggestion, the boy is working days at a drafting board, working nights on his engineering degree, and the suggestion committee is as proud as Columbus.

16 Ft to 0.0005 In.

LOW-ALLOY CAST IRON made possible a bar gage 16¾ ft long that had to be accurate to 0.0005 in. throughout its length. duPont wanted it for the Savannah River Project of the AEC. Willison Precision Scraping Co, Los Angeles, made it by precision scraping aided by optical alignment. Parts were cast by Axelson Mfg Co Div of Axloy, with a low percentage of nickel, inoculated at the cupola spout with ½% Nisaloy (60% Ni, 30% Si, 10% Fe). This avoided chilled white-iron edges, because the high specific gravity of the Nisaloy caused quick diffusion in the iron.

Doctorate

A 42-YEAR-OLD LEGLESS MAN forced to quit Fordham University 21 years ago because of financial difficulties has just been awarded a doctorate of laws there. He is Henry Viscardi Jr, executive director of Just One Break, Inc, a Bellevue Hospital (NYC) rehabilitation center for the physically handicapped, and president of Abilities, Inc, a Long Island pilot plant that uses only "cripples" as workmen in producing intricate electronic devices. Activities of the latter concern were described in an *AM* article about a year ago. Mr Viscardi was born without legs, had his first pair of artificial limbs in 1937.

Bum Color

AUTOMOTIVE DESIGN and engineering innovations are not always immediately accepted by the consuming public. But, usually, auto-company market research has a fairly good idea beforehand what the complaints, if any, are likely to be. Recently, however, researchers got a surprise. Object of customer complaint was that eye-coddling tinted glass. It louses up the Technicolor at drive-in movies.

First time we knew people at drive-ins look at the picture.

Operator

A YOUNG HIGH-SCHOOL GRAD was filling in an application form for his first job. He finally found an item he could answer. To the query, "What machines can you operate?" he wrote confidently: "Slot and Pin Ball."

Atoms and Plastics

RESEARCH in the atomic field reveals some remarkable effects of irradiating plastics. Lightly irradiated polyethylene, for example, becomes endowed with memory. If heated above the melting point, then deformed, it will return to its original shape.

Maybe this offers a brand-new solution to the problem of getting the ship into the bottle. You just melt it and pour it in, then reheat. Seriously though, it does seem probable that there could be some practical applications, such as positioning inserts in inaccessible locations. Inserts would have to be symmetrical.

Radioactive Sleuths

ANOTHER EXAMPLE of how industry is using radioactive tracers comes from General Electric's Chemical Materials Department where tracers measure erosion of plastic molds. A sprue bushing from a standard transfer mold is irradiated at Brookhaven, used in testing new molding compounds. One part of radioactive metal in 20 million parts of molded plastic can be determined, giving a quick measure of the wear rate. Result in new compounds already in limited production.

Forming Kink

LUBRICANT is generally brushed on aluminum sheet before forming in the aircraft industry because there are too many production changes to warrant automatic roll coating. At Convair Div of General Dynamics, the traditional paint brush has been replaced, as in many home painting operations, by paint rollers. The familiar sloping paint tray holds the wax or oil, and the roller applies lubricant faster and more uniformly, just as it does when you are applying paint to your kitchen ceiling.

News of Metalworking . . .

GUIDED MISSILES:

Is Technical Cloak-and-Daggerism Hiding a Snafu?

Congress wants to know just what's cooking with the $1-billion-a-year, secrecy-shrouded Guided Missile Program. One thing is sure—end results to date have been few and highly unsatisfactory

WASHINGTON—A new review of the Defense Department's $1-billion-a-year Guided Missile Program may well rock the Pentagon and produce cancellation of some present contracts and programs.

House to Investigate

A House Armed Services subcommittee, headed by Rep Chet Holifield (D, Calif), told Defense Secretary Wilson that the subcommittee is completely dissatisfied with conflicting reports as to the status of guided missile research, development, production and operation. It has asked for—and will get—a report on this by January 1955. And when it does, some heads may fall.

The responsibility for the new review falls under the Assistant Secretary of Defense (Research and Development), Donald Quarles, and his applications engineer, Frank Newberry. But in view of Congress's critical attitude, it seems unlikely that Wilson will be able to let these people draw up their own analysis and recommendations without calling in an outside specialist to head up the job. Wilson is on record as believing that the missile program is rolling along smoothly.

Top Priority

Guided missile research, production and development have been perhaps the highest-priority program the services have had since the end of World War II. But there have been tremendous complications because guided missiles are pushing into untried fields of supersonic speeds and highly complex mechanisms of many kinds. But the secrecy surrounding all phases of the program has prevented disclosure of information to anyone except those directly concerned with the projects. This in turn has hampered interchange of technical information.

And competition among the services for control of missile programs has created a rivalry which has helped to make it tough for outsiders to come up with any conclusions as to just how well we are doing.

Post-WWII Chaos

The result was chaotic in the years immediately following World War II. The services charged off in all directions—giving carte blanche to virtually any company with an idea. In October 1950, George C Marshall, then Secretary of Defense, appointed K T Keller, president of Chrysler Corp, to head up the Office of Guided Missiles. Keller accomplished a great deal in weeding out some of the less-promising research efforts: combined others, and pushed development and production of the more-promising missiles.

By 1953 he had wound up his job and returned to Chrysler. Just how successful he had been with the overall operation of guiding the missile machinery is cloaked in the same secrecy that shrouds the entire guided missile program.

$ Billions — for What?

This fact is inescapable—the Guided Missile Research and Development Program has cost billions since World War II. And its end items have been few—and they have admittedly been possessed of less-than-satisfactory performance. Not only that. Some of the guided missiles just now coming into production and operational use are actually obsolete as to range, speed and guidance systems before they're launched.

Grinding Charts Available for Classes

TWO 39 x 62-IN. WALL CHARTS, printed on heavy paper, are now available from Landis Tool Co, Waynesboro, Penna, for classroom use. One chart explains working parts and operation of a plain cylindrical grinder: the other, 24 typical cylindrical-grinding operations (AM Mar 31/54 p131). Copies are available free to apprentice groups and school shops, providing request is made on a business letterhead and indicates the number of apprentices or shop students in the group. Address requests to D H Ruth, advertising manager

1915 . . .

AND TODAY

Fanfare Launches Chrysler's New Proving Ground

CHRYSLER'S MULTI-MILLION DOLLAR, 4000-acre proving grounds at Chelsea, Mich, was officially opened June 16 with one of the greatest auto-driving shows in the industry's history, including time laps by the one-, two-, three-, four-drivers from this year's Indianapolis Speedway classic, a 143-mph lap driven by a girl in a souped-up Red Ram engined Dodge experimental model, a 24-hr endurance run by a standard Chrysler New Yorker at an average speed of over 118 mph for a new record, and a "hell driving" demonstration. Visitors from the press and industry, driven around the 4.7-mile concrete oval at speeds upwards of 100 mph, reported the track was so beautifully engineered there was "no sensation of speed at all." Chrysler estimates on a round-the-clock basis more than 2½-million miles of passenger car, truck and military vehicle driving will be logged this year alone. Aside from the oval itself, the proving grounds has a gravel endurance road, a two-mile stretch of Belgian Block (brick and rough asphalt), in fact all types of possible road terrain — so rough that 10,000 miles of proving ground driving is equal to more than 100,000 miles of ordinary automobile usage, according to Chrysler officials

TASA Goes to Washington

Aircraft service group moves into Washington quarters to become spokesman for that "distinct industrial entity essential to the national defense"—the specialized aircraft overhaul-modification company

WASHINGTON—The Aircraft Service Association (TASA), 18-month-old organization representing aircraft and engine-overhaul-modification and service companies, during its recent first annual meeting here established a permanent headquarters and office at 1001 Connecticut Ave, NW.

The new Washington office will aid the California-organized association in implementing its basic aims of getting government recognition of the important role the aircraft overhaulers play in national defense.

Harold C Stuart, a partner in the law firm of Doerner, Rinehart, Stuart and Clammer of Washington, DC, and Tulsa, Okla, was elected the association's second president at the annual meeting. He succeeds Thomas Wolfe, who has been named chairman of TASA's Board of Governors.

TASA's new president Stuart served as assistant Secretary of the Air Force from 1949 to 1951; was president of the Air Force Association in 1952; and chairman of AFA's board of directors last year.

According to ex-President Wolfe, the aviation industry can be divided into three basic components: (1) production of aircraft and components (represented by the Aircraft Industries Association); using agencies such as air carriers (represented by the Air Transport Association); and the service industry which maintains aircraft and engines, bridging the gap between production and flight. Companies in this category make up the Aircraft Service Association.

Governors Elected

Also elected to TASA's Board of Governors are: Douglass F Johnson, president, Aircraft Engineering & Maintenance Co, Oakland, Calif; C C Moseley, board chairman, Grand Central Aircraft Co, Glendale, Calif; J Kenneth Hull, president, Lockheed Aircraft Service, Burbank, Calif; W C Castleberry, vice president, Southwest Airmotive Co, Dallas, Texas; Maxwell W Balfour, vice president, Spartan Aircraft, Tulsa; and Robert McCulloch, president, Temco Aircraft Corp, Dallas. Board chairman Thomas Wolfe is president of Pacific Airmotive Corp, Burbank, Calif.

THE LABOR SCENE: The '54

When the smoke clears and the shouting dies down, the nation's industrial workers will come up with about 5¢-an-hour more in their pay envelopes. That's the opinion of Washington's labor experts. But the big tests are yet to come

WASHINGTON — Wage contract settlements in the nation's heavy industries are approaching the midway mark for 1954 — and a clear pay rise pattern is emerging. From here, it looks like workers in the automobile, heavy machinery and aircraft industries will get 5¢-an-hour more.

Much bargaining is still to be done. The International Association of Machinists (AFL) recently set new demands for fall negotiations with the aviation industry. Heading the list of IAM's contract goals was demand for a 35-hour week with no reduction in pay, plus "substantial" but unspecified wage increases, and more vacation, holiday, health and welfare and other fringe benefits. But aviation settlements generally will fall in line with new contract terms already under the wire this year in aircraft industries.

The big test of this year's industrial wage pattern is still to come. The giant CIO Steelworkers, currently bargaining with bellwether US Steel and other basic steel companies, will probably reach a new agreement shortly. Guessing among steel company and union officials on the probable new wage figures (old contracts expired June 30) range anywhere from 5¢ to 8¢ an hour, with a few cents more for higher pensions and other social insurance provisions.

Chances are the steel wage agreement will be closer to the lower figure (one top-ranking expert says 5½ ¢) in spite of the union's extensive demands for benefits topping the 50¢ mark. And the settlement should come without the embattled strikes of other years. This is why:

- The steel industry is operating at only about 70% of capacity (contrasted with over 100% in 1953) and no marked upturn is in sight. This means little money in the till for pay raises — although the industry is now ready to up pension benefits from the average $100 a month in steel toward the $137.50 pensions in the auto industry.
- CIO Steelworkers' President David J McDonald states privately that a full-fledged strike will not hurt the industry as much as it would if the furnaces were running full blast. A closed-down steel industry today, he says, would simply backlog orders. And it could operate at full capacity in later months to make up for the temporary production halt.

AVAILABLE ON FREE LOAN TO INDUSTRY

NEW YORK — A 20-minute sound-color film, "Stampings for Electronics," was premiered here June 16 before industry executives and the press by its creators, John Volkert Metal Stampings Inc, Queens Village, LI, NY. The film shows how precision parts are mass-produced for radio and television sets, military communications equipment and other electronic assemblies. All operations are covered from design engineering and tooling through production, inspection, finishing, assembly, warehousing and shipping. Featured are the design and function of progressive dies and Volkert's "precision in production" methods. Film is available on free loan basis to interested firms and groups.

"Stampings for Electronics"

VOLKERT'S PRESSROOM has batteries of automatically fed power presses, eyelet and multi-slide machines turning out precision electronic components

Wage Hike Pattern Is Taking Shape

• Other major industries are not making extensive settlements, so there's little pressure on steel companies to pay more.

A key to the new steel contracts comes from the auto industry. McDonald got a running start on a pay increase by virtue of the 5¢ productivity hike paid this month under terms of the running contracts between the CIO Auto Workers' Union and the major automobile producers. While this virtually assures the steel workers of more pay, it also effectively clamps a ceiling on the extent of the rise.

The United Auto Workers collected a net 4¢-an-hour — one cent was clipped off because of the falling Consumers' Price Index, to which the union's contracts are tied. When living costs drop, it hurts the effectiveness of labor's arguments for higher pay, a factor that will also be reflected when the steel negotiations get down to the wire.

The final union-US Steel settlement will set the pace — and the terms — for other basic steel contracts, as well as steel fabricating and other heavy industry agreements still to come. But with new benefits for auto workers all wrapped up for the year, and other settlements coming in day by day, the terms carry weight for the mid-year contracts in steel.

WHAT IAM WANTS

- 35-hr workweek with no cut in pay, overtime elimination.
- "Substantial" wage hike.
- Increased vacation and holiday schedules — 1 hr vacation for every 20 hr worked, plus eight paid holidays.
- Abolition of job analysis for setting hourly wages.
- Employer-paid medical and health benefits.

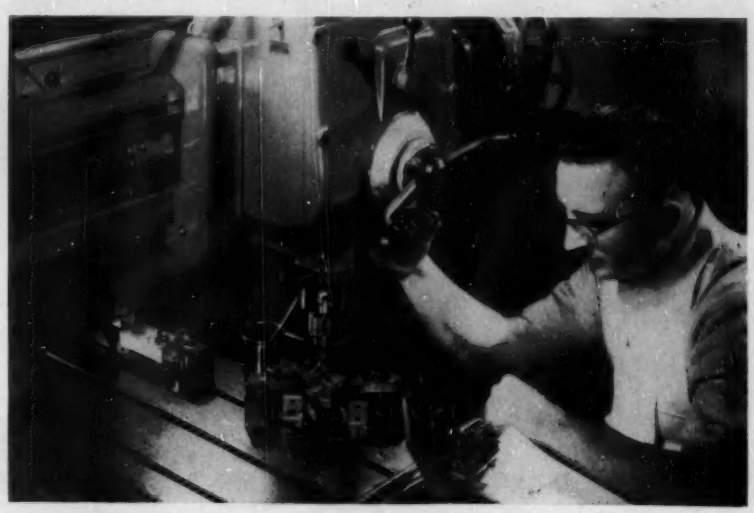
Here are some other recent important settlements that affect the 1954 bargaining picture:

• **Aircraft:** Convair Fort Worth and IAM settled for a 5¢ increase, plus some fringes. Curtiss Propeller plant in Caldwell, NJ, granted a 5¢ hike, with another 5¢ to be paid next year under a two-year contract. However, the company, while paying more into employee-insurance funds, took away the half-hour paid lunch period — virtually nullifying the first boost. On the other hand, countering this smaller-than-average agreement, Bendix Aviation's Montrose, Penna, plant paid an 8¢ increase to hourly rated employees.

• **Heavy machinery:** IAM signed the first union contract at Jeffrey Mfg Co, Columbus, Ohio, providing a 5¢ pay hike. Jeffrey is the nation's largest producer of mining machinery.

Current negotiations in other major industries are also hovering in the 5¢ area. General Electric Co, bargaining with the CIO Electrical Workers and scores of other unions, is offering an average 5¢ wage increase. Although this has temporarily been rejected by CIO, the final settlement shouldn't stray too far from the original GE offer.

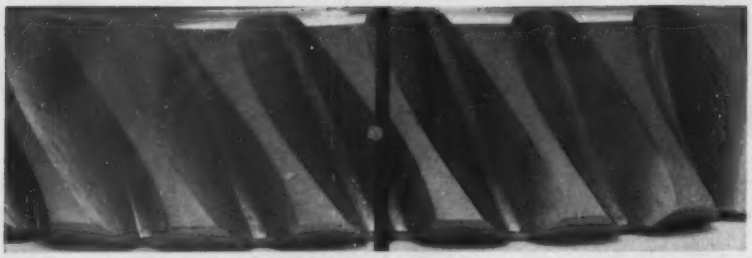
CIO's steel and electrical unions are also demanding the guaranteed annual wage, but this is certain to be rejected by the industries involved. This is the initial stage of the GAW drive and union members — more interested in full workweeks and full pay-checks — are not believed ready to battle to the finish for the guaranteed annual wage, a necessary attitude to win.



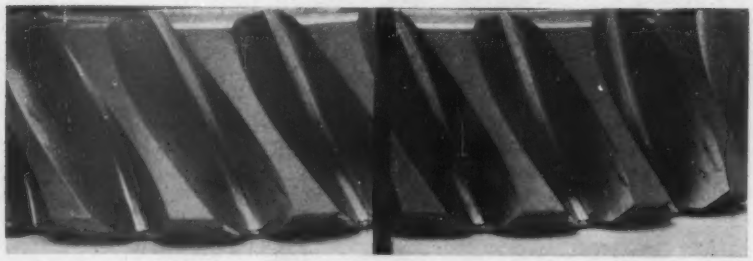
Film Premiered in New York

DETAIL DRAWINGS of every operation and section are the first step

HIGH-PRECISION JIG BORING OF A MULTI-STATION DIE. Volkert's toolroom is regarded as a "mechanical laboratory" where new methods are tried

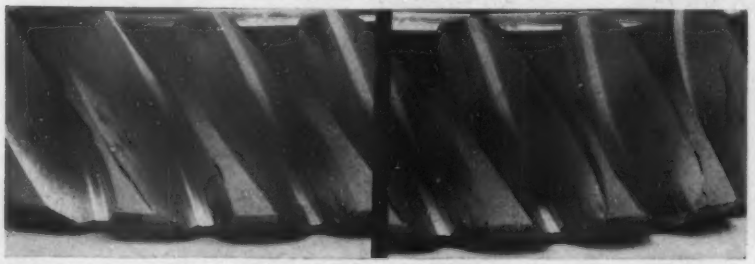


HOBBED WITH FLYTOOL SET ON SIZE, with lead gearing on hobber and center distance standard. Hob arbor at right angles to blank. Contact on coast side unsatisfactory until worm was reground with lead 0.010 in. long on that side only. Cause was not determined. Final contact substantially 100% on both side, excellent considering that meshing was in a test stand without load.



TOOL SET OUT RADIALLY 0.014 IN., lead gearing shortened to 5.4889, and hobbing center distance increased 0.014 to attain 0.001 in. ease-off according to Wildhaber. Calculated tilt of 13′ 50″ proved too high in tests so was cut to 10′ 50″. Contact on drive side then was centralized and very satisfactory, on the coast side was likewise concentrated but a little below centerline.

ALL MODIFICATIONS WERE DOUBLED to obtain still more concentrated center bearing with about double ease-off. Angle of tilt, calculated at 27′ 40″, proved excessive, so was cut to 25′ 40″. Contact on drive side centralized, with a substantial amount of ease-off, but contact on the coast side was largely across the gear face.



HERE THE FLYTOOL WAS SET IN RADIALLY 0.05 in. under standard, like a much sharpened hob. Lead gearing was 5.4921, center distance decreased 0.04 in. Calculated tilt of 50′9″, opposite in direction from the previous oversize experiments, was again too high; best proved to be 40′ 0″. Contact could not be centralized so was somewhat catercornered, but there was no hollow area in the middle of the tooth, even though the tool represented an undersized hob.

Tests Evaluate Wildhaber Formulas

Granger Davenport, Gould & Eberhardt's chief engineer, shows effects on wormgears of setting on size, oversize and undersize, according to the Wildhaber hob proposals. One indication: lead should be lengthened on the coast side

IRVINGTON, NJ — Several wormgear sets have been cut here recently at Gould & Eberhardt Inc to test the Wildhaber formulas (*AM* June 21, p149) for designing oversize hobs to provide a specified amount of ease-off at both edges of teeth.

The worm was 5-thd, 1.1 AP, 5.5 lead, 3.5 PD (approx), 27° LH lead angle (approx), PA of the double-conical, straight-sided 20-16 in. dia grinding wheel was 25°. Material was case-hardened steel. Wormgear has 27 teeth, about 9.5 PD, and is chilled nickel bronze.

Sets were cut with a carbide-tipped flytool of shape closely approximating a normal section of the worm tooth, plus extra tip material to cut clearance on the bottom of the teeth.

Gears were cut on a G&E 30TWG wormgear hobber with tangential feeding. A J&L worm grinder usually ground both sides of teeth simultaneously.

Experimental results pictured here indicated a need for lengthening lead on the coast side, to the extent of 0.010 in 5.5 in. It could have been a worn part in the particular hobber, according to Granger Davenport, chief engineer, who presented these data at the AGMA meeting June 8.

LOW-GRADE IRON ORES:

At Long Last, Ford Finds a Way to Use 'Em

Is a metallurgical problem almost as time-honored as the old alchemists' search for ways to turn base metals into gold now solved? Ford thinks so — its philosopher's stone: "froth floation" of iron-bearing cruhed jasper rock

DEARBORN, MICH — Experimental iron ore concentrate from low-grade deposits in the Upper Peninsula of Michigan is now being produced by Humboldt Mining Co, near Ishpeming, Mich, jointly owned by Ford and Cleveland-Cliffs Iron Co. This, Ford officials say, may be the answer to the rapid depletion of high-grade iron ore deposits.

Humboldt's experimental iron ore concentrate is said to be "far higher" in iron content than the Lake Superior "direct shipping" ore on which steelmakers largely depend today.

Until completion of a pelletizing plant near the iron deposits, Humboldt's product is being stabilized by mixing with standard ore before shipment on an experimental basis to Ford's Rouge plant in Dearborn, Mich. There, before it is fed into blast furnaces, the concentrate is mixed with flue dust and sintered into large chunks.

Humboldt's concentrating process was developed by Cleveland-Cliffs at its Ishpeming research laboratory. The process is unlike methods developed for use on low-grade Minnesota ore deposits, where iron ore particles can be removed from waste materials by magnetic separation. The Humboldt material is non-magnetic and must be otherwise concentrated.

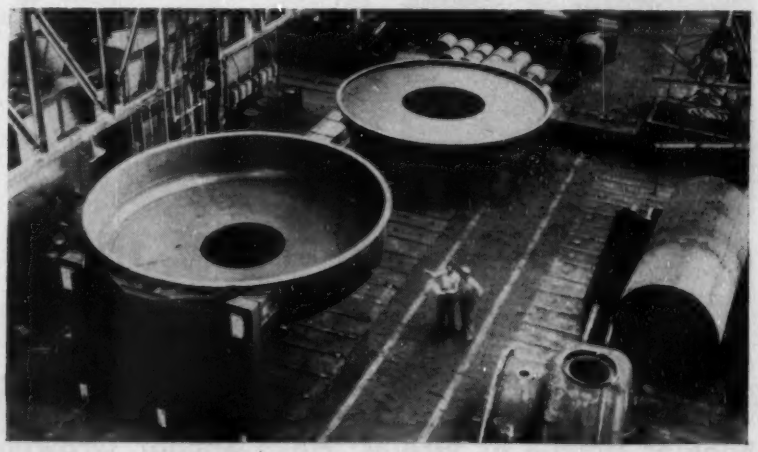
Humboldt calls its process "froth floation." It involves mixing crushed iron-bearing jasper rock with water and chemicals, then agitating the mixture by air pressure, causing froth to rise to the surface of the concentrating tanks. Iron ore particles adhere to the froth. Waste material drops to the bottom of the tanks. Froth is then skimmed off and moisture removed. Two tons of crude materials are needed to make one ton of concentrate.

Annual Output: 250,000 Tons

Humboldt's first concentrating facility employs about 90 people, has an estimated annual output of 250,000 gross tons. The plant is operating experimentally on three shifts, five days a week. Total production for this year will be in the neighborhood of 150,000 tons of concentrate.

In the next four years, Humboldt's Unit 1 alone is expected to recover as much or more iron ore than was mined from the property in the 55 years it previously was worked. The mine there closed down in 1920, has been idle since.

Humboldt plans to construct a second unit in the near future, of equal production capacity and agglomerating facility.



Spun Steel Heads for Biggest Clamshell

WEIGHING TOGETHER UPWARDS OF 22 TONS, these spun steel heads fabricated by Lukens Steel Co for United Aircraft's Hamilton Standard Division will form the world's first clamshell — a device for measuring the dynamic imbalance of airplane propellers. Spun on the world's biggest flanging machine, at Lukens' Coatesville, Penna, plant, each head was fabricated from two 1¼-in. steel plates, welded together and cut to a 281-in. dia disk. Final dia of the heads shown is 20 ft, 6 in. To give the assembled chamber the depth required for a revolving propeller and instruments, a cylinder of the same dia was welded to one of the heads.

Ford expansion:

"YOU AIN'T SEEN NOTHIN' YET"

BOSTON — Ford is planning expansion "that carries the biggest dollar sign in company history." That's what Benson Ford, general manager of Ford's Lincoln-Mercury Division, told advertising men here.

"Far and Fast"

Motor car manufacturers are moving ahead "as far and as fast as we can go," Mr Ford said. Ford's tremendous expansion plans are, however, only tentative, subject to management approval, and to changing economic conditions.

One Wrong Guess—Blooey!

"If we guess wrong on our long-range plans," Mr Ford added, ". . . we (Ford) can take a really serious drubbing."

New Ford Research Center

Ford plans to consolidate all its manufacturing research development centers into one giant facility. Object: new methods for an expanding market

DETROIT—Ford Motor Co will start construction shortly on a central manufacturing facilities building for research on manufacturing methods and processes, it is announced by D J Davis, Ford's director of manufacturing engineering.

West of Detroit

The new research center will be located near Lincoln-Mercury Division's general parts depot at 12723 Telegraph Road, just west of the Detroit city limits. The facility will contain laboratories, and testing rooms and will be a consolidation of five manufacturing engineering development departments now located at Ford's Rouge plant in Dearborn.

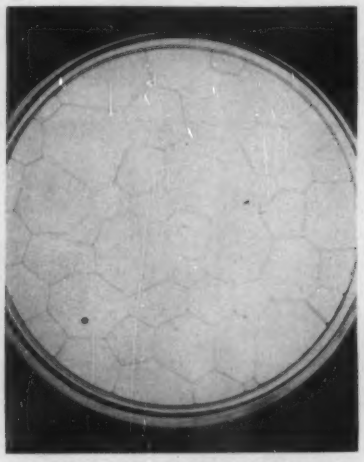
According to Mr Davis, "the basic objective of the new manufacturing development facility is to accelerate advancements in manufacturing methods. . . . In recent years, there has been a rapid increase of new manufacturing methods which may be applied advantageously to a wide variety of processes in the production of automotive parts and components."

And, says Mr Davis, "to develop and keep up with the many technological improvements being introduced in industry, and to apply these new methods as efficiently and as quickly as possible, are the fundamental aims of our work."

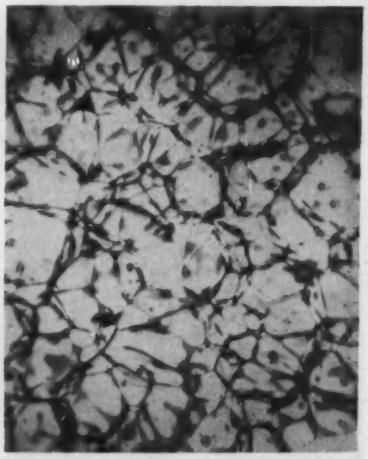
One-Story Building

Present plans call for a one-story building 240 ft wide x 360 ft long, with a total floor space of 86,400 sq ft. Provisions have also been made for future expansion.

CAPTIVE BUBBLES in cells help G-E researchers study metal behavior



SOAP BUBBLES GROW LIKE THIS, are hexagonal at this stage



AND SO ARE METALLIC GRAINS at a certain stage in heating

Bubbles Double as Grains: Have Similar Growing Pains

SCHENECTADY, NY — GE scientists here are deep in a study of soap bubbles. They're not reverting to a childhood admiration for the iridescent spheres — the idea is pure research into the behavior of metal grains. It seems that soap bubbles, when shaken up in "bubble cells" (see illustration) react in the same way as metals subject to heat changes. When first shaken, the cell shows thousands of tiny bubbles: allowed to stand for 10-15 minutes they form larger and fewer bubbles. Number of sides per bubble vary as time goes on. But when there are only three sides to a bubble, it disappears. When a metal is heated, some grains enlarge, other disappear, just as soap bubbles do. This resemblance may open up new fields in metals research.

MAPI Washington Conference:

Export-Import Bank Gets Industry Backing

But metalworking executives attending Machinery & Allied Products Institute's Annual Washington Conference were of a more divided mind on the controversial subject of machine-tool leasing

WASHINGTON—With its authority reaffirmed and strengthened by Congressional action now pending, the Export-Import Bank should develop into the "most important single instrument for constructive international economic policy," according to South Carolina's Senator Burnet R Maybank, who made the prediction at the Annual Washington Conference of the Machinery & Allied Products Institute June 24-25 at the Hotel Statler here.

Senator Maybank said that a sound loan program must be developed as an alternative to a program of grants and relatively unsound international loans. Under the provisions of the Senate bill, the bank's loan, guarantee and insurance limit would be $5 billion.

MAPI Favors It

MAPI went on record with the Senate as favoring the Export-Import Bank's taking full advantage of its new authority to "assist in putting the American manufacturer in the same position in extension of credit terms as his foreign competitor finds himself, due to foreign government underwriting of credit terms." This assistance would take the form of economic development loans and exporter financial help.

Leasing is a coming and very effective way of financing industrial equipment orders, Frank Griesinger, assistant treasurer, Lincoln Electric Co, Cleveland, told MAPI members. His company sees in leasing a possible expansion of its sales of welding equipment, plus more and better control of its own make of used equipment. Lincoln has extensive rebuilding facilities.

Mr Griesinger stressed the fact that Lincoln does not normally include a purchase option in its leasing contracts.

Leasing, he pointed out, is a costly method of acquiring and using equipment. On the other hand, it is the least expensive means of financing modernization and expansion of facilities, as long as it releases capital for other profitable usage.

The risks of leasing today, plus the uncertainty of tax regulations, makes this kind of business dangerous, Jerome A Raterman, president, Monarch Machine Tool Co, emphasized. A lessee should not have a tax advantage over a cash customer. But at the same time, the lessee should not be saddled with a tax cost that puts a penalty on leasing, he said.

Insurance Against Hazards

Mr Raterman added, "When leasing machine tools today, we are giving the customer an insurance policy on all the hazards of ownership without having actuarial facts to establish our rates." While rentals admittedly are high, he said, they are reasonable in the light of the great risks assumed by the lessor. If a lessee cannot keep a machine busy, he has the privilege of returning it.

Lessor Takes the Risk

But, he said, if the lessor finds himself with a large inventory of leased machines that have been returned, he might have to defer introduction of new models.

The cost of repossessing a machine tool, then rebuilding it for resale, is very high, Mr Raterman said — the overhauling charge alone is as much as 55% of the replacement cost. That's the experience of many machine tool makers.

Leasing Is Needed

Mr Raterman made it clear that he was not condemning the leasing of capital goods. Numerous plans in many fields have proved the need for such service. And a set of rules fair to both lessee and lessor has emerged from many years' experience. On the other hand, he pointed out the hazards of evaluating cost of leasing equipment with a long life against equipment with a short life.

Mr Raterman also expressed the belief that the new depreciation rates to be set up by Congress will cause machine tool customers to take a new look at leasing vs ownership.

Northrup to Install US' Largest Sheet Metal Stretch Press

HAWTHORNE, CALIF — America's largest sheet metal stretch press will shortly be installed here by Northrop Aircraft Inc, builders of the Scorpion F-89D all-weather interceptor and the Snark B-62 pilotless bomber. The new Sheridan stretch press will be capable of forming large sections of fighter fuselage and wing skins in a single operation, accomodating aluminum sheets up to 14 x 20 ft.

The press will have a rated stretching force of 750 tons. Its hydraulically actuated mechanism can lift the equivalent of 500 automobiles simultaneously.

Now in early installation stages, the press will be mounted in a 57 x 33-ft pit, 20 ft deep. Northrop expects to have the press in operation before August 1.

Northrop is installing the press in collaboration with the Air Force. And says Northrop, some indication of the foresight and advance planning going into its installation is the fact that the press can stretch form aluminum stock 3 ft wide and ½-in. thick, while today's top-performing aircraft ordinarily don't have fuselage skin surface more than a quarter-of-an-inch thick. For economy of overall operation, the press will be teamed with Northrop's automatic riveting equipment.

Jacob J Jaeger

Berton E Rogers

Hardage L Andrews

Names in the News . . .

Jacob J Jaeger has been appointed to the newly-created post of chief engineer of Pratt & Whitney's Machinery Engineering Dept. Mr Jaeger became associated with the organization in 1940 as a research engineer, and was made assistant manager of machinery engineering in 1951.

R A Carlson has been appointed vice president and manager of engineering for Borg-Warner Corp's Rockford Clutch Div; he moves up from the post of chief engineer. **E R Williams** has been promoted to sales manager; **F C Fager** succeeds Mr Williams as assistant sales manager. **E C Shields,** vice president and general sales manager of the division, has retired after 25 years' service in that capacity.

Robert W Kerr, deputy executive of American Machine & Foundry Co's General Products Group has been named a divisional vice president and group executive. In this capacity he will direct operations of the General Products Group, which includes AMF subsidiaries. Prior to joining the company in January Mr Kerr was president of Bingham-Herbrand Corp of Toledo and Fremont, Ohio.

Robert R Dickson has been appointed to the newly-created post of production manager of Boeing Airplane Co's industrial products division at Seattle. His former duties as experimental production planning chief have been assigned to **Dwight Norsen,** former general supervisor of production planning for the XB-52 and the YB-52.

Berton E Rogers has been named general factory manager for Vickers Inc. He will be in charge of manufacturing and production activities at company plants in Detroit, Omaha, and Joplin, Mo. Prior to the appointment Mr Rogers was vice president in charge of manufacturing for Motor Products Corp.

Ernest E George, manager of design and application engineering of General Electric's Carboloy Dept, has been named manager of magnetic products engineering. Mr George, a member of the firm since 1933, has been Carboloy manager of magnetic materials since 1950.

Norman L Mochel, manager, metallurgical engineering, Westinghouse Electric Corp, has been named president of the American Society for Testing Materials. He served as vice president during 1952-54. **Rudolf A Schatzel,** vice president and director of engineering, Rome Cable Corp, has been elected to a two-year term as the Society's vice president.

Norman L Mochel

Hardage L Andrews, president of Jones & Lamson Machine Co, has been appointed to the National Association of Manufacturers' board of directors. Mr Andrews, who is also a director of Jones & Lamson, and a director and member of the executive committee of Manning, Maxwell & Moore, was executive vice president of General Electric Co prior to his appointment to the presidency of J&L in 1953.

Warren H Brand has been named director of engineering and research, Conoflow Corp, Philadelphia. He formerly served with the Atomic Energy Commission as supervising engineer of the Industrial Instruments Engineering Section at Oak Ridge National Laboratory.

Whitney C Collins has been elected president and chief executive officer of Northrop Aircraft; he succeeds Major General Oliver P Echols who died May 15. Mr Collins is president of the Radio Plane Co, a Northrop subsidiary, chairman of the board of Holga Metal Products, and a partner of Collings-Powell Co.

Rudolf A Schatzel

Stanley C Amren

George A Roberts

A O Schaefer

Stanley C Amren has joined Cleveland Welding Co, American Machine & Foundry Co subsidiary, as vice president and general manager. Mr Amren served as quality control director for U S Time Corp, and manager of its Little Rock, Ark, plant for the past four years.

John L Hallett has been named vice president in charge of aircraft production for Kaiser Metal Products, Bristol, Pa. He was formerly executive vice president of Kaiser Motor Corp. **Paul C Meyer,** executive assistant to the vice president and general manager, has been appointed vice president in charge of administration.

James Diamond has been named manager of General Motors Corp's jet engine plant at Willow Springs, operated by the Buick Motor Div. Mr Diamond was formerly manufacturing superintendent of the plant.

Joseph F Hutchinson has been appointed assistant general manager of Goodyear Tire & Rubber Co's Metal Products Div. He joined the company in 1946, and has been serving as divisional superintendent since 1951.

OBITUARIES

Lloyd E Honeywell, 66, advertising manager of National Acme Co, Cleveland machine tool builders, died suddenly at his home June 7. Mr Honeywell, who retired last year, had managed the company's advertising for the past fifteen years.

Russell C Manning, 61, sales manager and director of the Rotor Tool Co, Cleveland, died June 11 at his home. Mr Manning had been a member of the organization since 1933; prior to that he had been associated for many years with Ingersoll-Rand.

George A Roberts, vice president, technology, The Vanadium Alloy Steel Co, Latrobe, Pa, has been named president of the American Society for Metals for the 1954-55 term. He has been serving for the past year as vice president. **A O Schaefer,** vice president in charge of engineering and manufacturing, The Midvale Co, Nicetown, Pa, has been appointed to a one-year term as vice president of the Society.

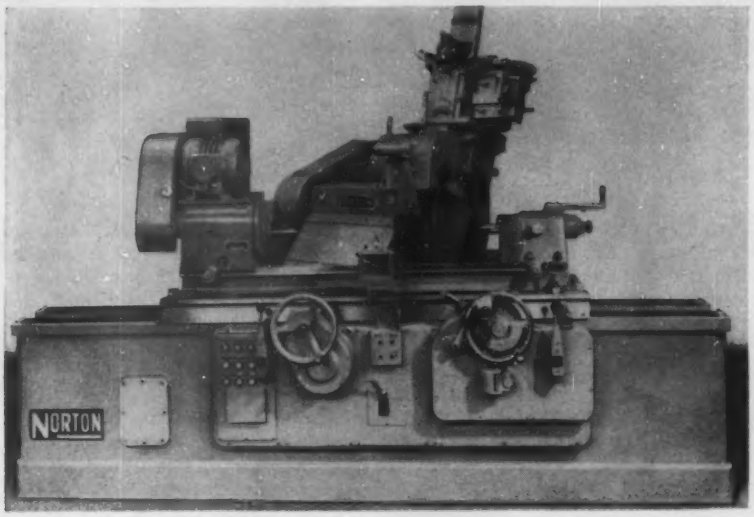
S H Newburn has been appointed president of Air Reduction Canada Ltd, a division of Air Reduction Co, which he joined in 1936. Since 1950 he has been manager of the North Central Region of Air Reduction Sales Co. **D F McCandlish,** Chicago district manager, succeeds him.

Ambrose J Wardle, Jr, has been appointed vice president in charge of sales, McKay Machine Co, Youngstown, Ohio, and **Carl J Honen** vice president, advertising and sales promotion. Both previously were assistants to the president.

Semon H Stupakoff, formerly president of Stupakoff Ceramic & Mfg Co, Latrobe, Pa, has been elected vice president of the Carborundum Co, Niagara Falls, NY. Mr Stupakoff's organization was acquired by Carborundum early this year and has recently been made a company division. As vice president of the parent concern, Mr Stupakoff will continue to direct activities of the division, manufacturing components for the electrical industry.

ALBERT E HENN (center) sales manager of National Acme Co's Machinery Div, receives a diamond-studded pin to commemorate fifty years of continuous service with the Cleveland firm. The 50-year pin was presented by President F H CHAPIN (right) and Executive Vice president C W SIMPSON. Mr Henn's father, E C Henn, was one of the founders of the company in 1902

New Shop Equipment,



Angular Wheel Slide Grinder Cuts Production Time and Cost

Type CV-4 semiautomatic angular wheel slide grinding machine has been announced by Norton to replace the Type C angular machine. The new machine rapidly grinds thrust surfaces and adjacent diameters simultaneously in a single, automatically controlled plunge grind. It eliminates the separate operation normally necessary when similar jobs are done in conventional cylindrical grinders. The machine produces a concentric grain pattern in the finish of the shoulder or thrust surface ground.

Faster sizing qualities and simplified operation are built into the machine. Accurate sizing comes from feeding efficiency of the Norton CTU wheelfeed mechanism with hydraulically rotated, micrometer-screw feed. This mechanism also includes a click-count index with which settings for work diameter reduction in increments as fine as 0.0001 in. are made.

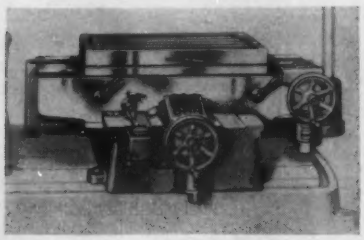
Operation is further simplified in that both the length and rate of automatic feed are set from the normal operating position. In addition, handwheel which adjusts grinding wheel feed has been located on machine base at operator's right hand. This graduated wheel continually indicates amount of feed as it rotates past a fixed pointer in both manual and automatic feed.

Normal operation requires three actions: operator loads, touches a one-loader control which starts automatic grinding cycle, and removes work. Further simplification is obtained with the automatic wheel-guard truing device, an extra item which trues wheels to required form at touch of a pushbutton and gives uniform control of amount of abrasive removed from the wheel.

The machine is constructed with heavy wheel spindle unit with standard Norton full-round, long spindle bearing. It will also mount grinding wheels with faces up to 8 in. Other design factors are: coolant tank has ramped outlet; pumps and motors on the outside; electrical controls are grouped in enclosure; hydraulic oil and ways lubricant reservoirs are conveniently filled and cleaned, outside types, with sight gages. Base ways are protected by steel tape guards. Electrical and hydraulic equipment conforms to JIC Standards.

Type CV-4 is available in 10- or 14-in. swings and in 36-, 48- or 72-in. work lengths. In addition to hydraulic-power table drive, an auxiliary hand drive mechanism is provided. When wheel guard truing is installed, hand table drive only is provided.

Norton Co, Worcester 6, Mass



Automatic Positioning Table For Fosdick Radial Drills

Fosdick automatic positioner, which has been in use on Fosdick jig borers and automatic positioning machines, is now available as a separate unit. It is reported to give exact reproduction of precision drilled, bored, tapped and reamed parts without jigs and without setting stop adjustments. Once two duplicating bars are prepared, positioning of work is done automatically at touch of a button accurate to ± 0.0001 in.

The automatic positioner can be installed for use with existing rigid, radial equipment. Because positioner moves the work, radial is used in clamped position with spindle located stationary.

Fosdick Machine Tool Co, Cincinnati 23, Ohio

Aluminum Precision-Formed By Chemical Process

Chem-Mill is a process for precision forming of metal parts from aluminum sheets and forging stock by immersion in chemical solutions. It was originated by North American Aviation and developed in conjunction with Turco Products, Inc. Turco is licensed to make the process available to other manufacturers.

The Chem-Mill process, designed to replace the milling machine in many operations, offers contouring without the application of physical force. It is reported that equipment

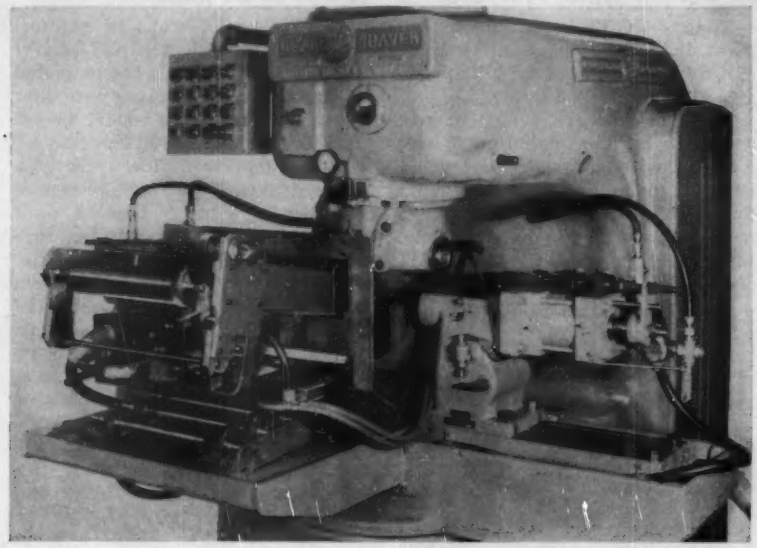
Materials and Parts . . .

costs are low and facilities can be quickly installed. The process is said to be ideal for the mass production of parts.

One of the greatest advantages of the process is that it can be used to produce precision contouring of forgings or intricately shaped and curved aluminum sheets. This permits the use of the process for re-dimensioning of parts to closer tolerances. It is reported to permit the holding of close tolerances on almost any desired complexity, and to permit tapering, curving, and other intricate shaping.

While Chem-Mill is being confined at present to aluminum alloys, its application to other metals is being developed.

Turco Products, Inc, 6135 South Central Ave, Los Angeles 1, Calif



Red Ring Automatic Loader Speeds Shaving Operations

Red Ring loader handles long-shaft unsymmetrical gears on standard rotary shaving machines. It has a built-in gaging device, magazine feed, air-powered loading fingers, and discharge chute.

Specially designed set of lever trip fingers in both input magazine and discharge chute keep gears from touching each other. Operation is completely automatic when used in conjunction with standard rotary gear shaving machine equipped with suitable controls and air-powered tailstock.

Loader illustrated handles a 14-diametral-pitch, 3¼-in.-OD, 1-in. wide gear, with integral shaft 17½ in. long at rate of 180 gears per hour. The gear is 15⅜ in. from one end of the shaft in setup illustrated.

Operator fills input magazine and presses cycle button. Air cylinder advances feed slide with one gear toward cutter and feed fingers mesh work gear with cutter. While gear is being shaved, feed slide retracts to loading position where another gear drops into position.

Oversized gears are gaged before entering input magazine by being passed between two mating gears mounted on fixed center distances. In this design, gears are loaded in pivoted carrier which has hand lever that is raised to pass long-shaft gears through gaging gears and into input magazine in square relation.

National Broach & Machine Co, 5600 St Jean, Detroit 13, Mich

. . . including

Circular saw cuts stock up to 43-in. dia, either ferrous or non-ferrous metals . . . page 174

Tracer attachment converts lathe to contour work with automatic cycle on uninterrupted cuts . . . . . page 176

Press brake, all-steel, can be used for high-speed punching and automatic feeding applications . . . . . page 178

Turning and grinding machine is applicable where close tolerances on concentricity and parallelism are required page 180

Band machine has attachments which allow tailoring machine to individual needs . . . page 182

Machine grinds bevels of all straight knives and shear blades at high rate . . . . page 184

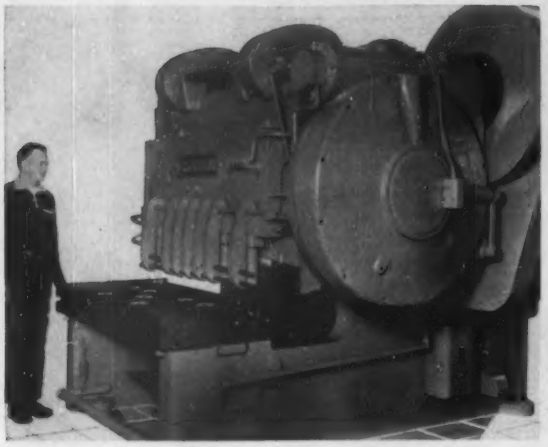
Contour projector now has 30-in. viewing screen and 17-in. throat . . . . . page 186

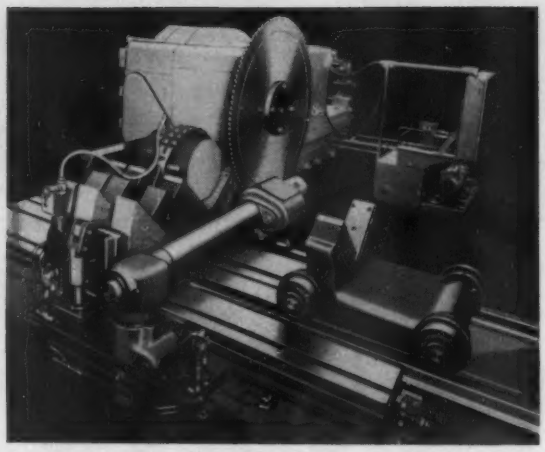
Shaper provided with chrome-plated ways on ram of 70 R. hardness . . . . . page 188

. . . and in July 19

Automatic gear gaging and sorting machine makes up to four checks on gears for both size and helix accurracy.

Electronic micrometer built by combining standard units measures small parts to 0.00001 in.





Shear Cuts Mild Steel Of 1½-in. Thickness

Cincinnati all-steel shear is capable of cutting mild steel of 1½-in. thickness by 4 ft long.

Machine is equipped with front-controlled power-operated back gage having 48-in. back gage range. The back gage angle itself is hinged to allow passage of plates longer than back gage range.

Machine is constructed of all-steel rolled plate and has an interlocked construction. It is powered by a silent worm gear drive, has hardened multiple jaw clutch, hydraulic hold-downs, light beam shearing gage, and ball transfers in the table for easy feeding of heavy plate. Safety friction for the flywheel and slitting adjustments is also provided. Additional features are a special long scrap chute and air counterbalances on the ram.

The Cincinnati Shaper Co, Hopple, Garrard & Elam Sts, Cincinnati 25, Ohio

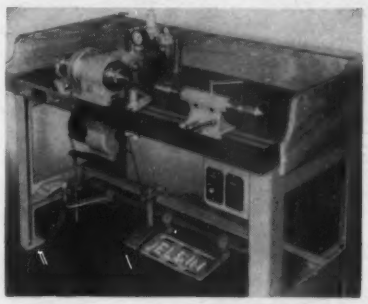
Two-Wire Miniature Thermostat For Limited Space Applications

Miniature temperature controls, called Midget Thermoswitch, are ¼ in. in diameter and approximately 2⅜ in. long. Because of small size and double-lead design, the thermostat may be used (with suitable relay circuit) as a precision temperature controller in any heated device, such as a platen, where installation space is closely limited. May also be used as an overheat detector in high-rpm machine bearings, ovens, oil pumps, heater ducts, or wherever overheating might endanger a process or mechanism.

Under continued 10 G vibrations exerted along each of three mutually perpendicular planes, unit will reportedly maintain its preset actuation temperature to approximately 5 F. It is factory set to actuate at any selected temperature in the range of —65 to +450 F. Depending on set point, it is said to have an accuracy of 1 to 5 F. Designed for 1-amp service at 115 v ac or 32 v dc.

Three models are available: one with a triangular mounting flange; a second with a threaded hexagonal head for mounting in a tapped hole; and a third with a stud locator to facilitate mounting in a slotted hole. List prices range from $12 to $14 each.

Fenwal Inc, Ashland, Mass



Desk Model Lathe

Production lathe provides desk-high bed and spindle plus operating lever and pedals placed for fast action. It provides for instant run-stop and collet position control, thereby being an ideal machine for short turning, facing, crimping, and similar operations.

It is made in two models, the 4P7 with ¾-in. draw-in collet and the 11/16-in. stationary collet. It has a 7-in. swing, 15 in. between centers, speeds to 4000 rpm, and may be equipped with compound slide rest, double cross-slide, 6-hole turret, and other standard bench lathe accessories.

Elgin Tool Works, Inc, Dept E, 177-Berteau Ave, Chicago 13, Ill

Circular Sawing Machine Cuts 43-in.-dia Stock

For cutting off ferrous or non-ferrous material, Motch & Merryweather Machinery Co has extended its line of circular sawing machines by adding the No. 5 model to cut stock up to 43 in. in diameter.

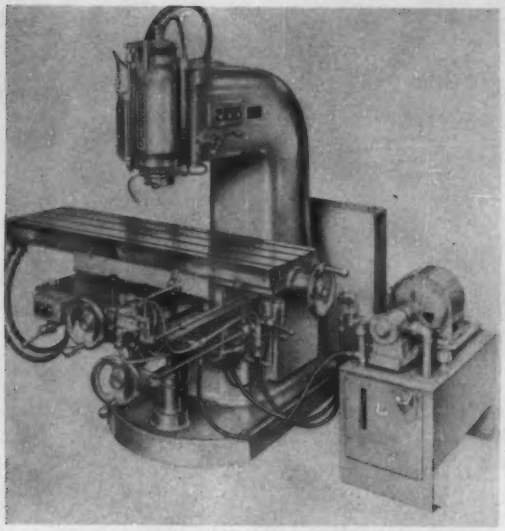
In the non-ferrous, low-speed type pictured above, the saw carriage is mounted on a heavy base at right angles to a heavy slotted work-supporting table. The saw carriage, single-speed type, has additional feed variations available by means of sheave change, or by change gears. This saw head is powered by a 30-hp, 900-rpm motor connected by multiple belts and sheaves to the gear train. Final spindle drive has large, heavy-duty herringbone gears. Face of spindle is 20 in. in diameter, with four pins supplying mounting and saw blade drive.

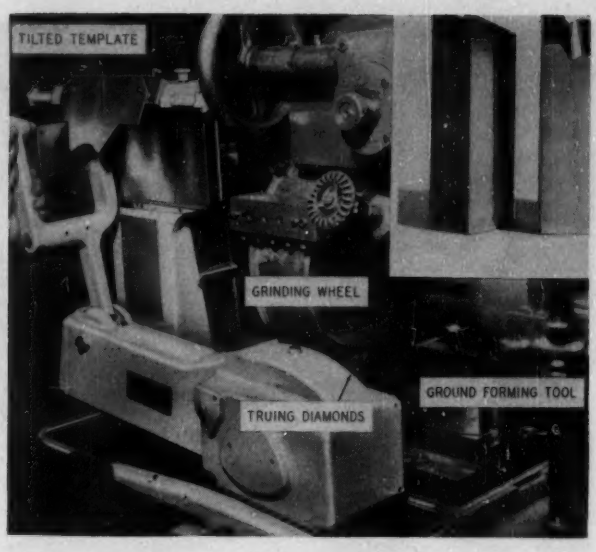
Stock is placed in V-block at front of machine. Clamping is by hydraulic cylinder connected through linkage to heavy roller chain. Larger diameters are accommodated by removing jaw sections of the V-blocks. Large elevating roller assists in elevating stock from V-block and moving it forward. Power is supplied by gear-head motor. The roller is elevated by two hydraulic cylinders interconnected through work-holding base. Additional support is provided by heavy-duty dolly mounted on rails adjacent to work-holding base.

The Motch & Merryweather Machinery Co, Penton Bldg, Cleveland 13, Ohio

Plast-Iron B-212 is a reduced-oxide compacting powder recommended for manufacture of mechanical parts (not bearings) where exceptionally high tensile and transverse strengths and wear resistance are required without need for high ductility.

National Radiator Co, Johnstown, Pa





Onsrud High-Speed Miller Works Non-Ferrous Metals

Model A-245 milling machine is a medium size hydraulically powered unit said to increase normal milling speed of all sizes and shapes of parts from 100 to 600%, and to cost less than conventionally priced machines.

Machine incorporates: centrally located, simplified hydraulic-feed controls; manual control which can be cut in at any time; directional, knee, cross, and table-feed control with five forward and reverse positions, including rapid traverse; and table speeds from 0 to 150 ipm.

The 7½/15 hp, 3600/7200 spindle motor is raised or lowered by air and manually operated for close adjustment. Three specially designed valves actuate hydraulic feeds of table in all directions. Dogs limit table travel, resetting valves to "off" position. A lever on each valve is moved in the direction of required travel and table speed increases as lever angle is increased. Thus, each valve combines control of direction speed and travel limit.

Knee can be locked to any height with gib clamp which is interlocked with hydraulic lift. Gib must be unlocked before vertical travel can begin.

Pushbuttons for starting cutter motor, and high and low speed, are mounted on side of head column. Cutter motor can be raised or lowered 8 in. by air pressure, or manually for fine adjustment. Gib clamp locks cutter motor in position.

Capacity is 19¾ in. less cutter width, and length is 28 in. Table is 14x26 in.; travel is 28 in. at from 0 to 200 ipm. Cross-slide travel is 14 in. at from 0 to 200 ipm, knee travel 10 in. from 0 to 50 ipm. Lubrication is provided by mist feed on motor and Bijur pressure feed on table and cross-slide. Coolant mist feed is supplied to cutter.

Onsrud Machine Works, Inc, 3910 Palmer St, Chicago 47, Ill

Delta Grinders Are Improved

Improved models of the single-phase and three-phase standard 7-in. grinders and buffers will sell at the same price. Single-phase models have capacitor-start motors in place of earlier split-phase motors. All single-phase and three-phase models, except 550v, have been changed from single to dual voltage. The manufacturer states that the higher starting torque provided by the capacitor-start motor means faster, easier starting, and higher breakdown torque reduces stalling.

The dual voltage feature allows the improved single-phase models to operate on either 115 or 230-v current, and three-phase models on 220 or 440 v.

An additional new feature of the three-phase models is a separate toggle switch for the lamps. Other features include: oval-shaped motor end bells and extended motor shaft; fully machined and adjustable tool rests with working surfaces on both sides of wheel; no-glare twin-light shields with double-thick safety glass; single-stud shield mounting; fully tested guards; adjustable spark guards and natural fan action which sucks in all dust and sparks and discharges both through tube at rear of wheel.

Delta Power Tool Div, Rockwell Manufacturing Co, 432 N Lexington Ave, Pittsburgh 8, Pa

Cutter-Relief-Angle Grinding Simplified

Diaform wheel-forming attachment was designed to simplify grinding of relief angles on forming tools. Available in three models, it works on pantograph principle and eliminates need of distorted templets, projection drawings, and lengthy calculations.

Templet is mounted on templet carrier, which has graduated scales, and carrier is tilted to included angle of both end relief and top rake. For side relief entire carrier is swiveled to desired angle. Wheel is form-trued by lightly traversing tracing bar over profile of tilted and swiveled templet. Path of tracer is transmitted through pantograph mechanism at 5:1 or 10:1 reduction ratio to the truing diamonds which quickly form-true the grinding wheel to the "distorted" templet form.

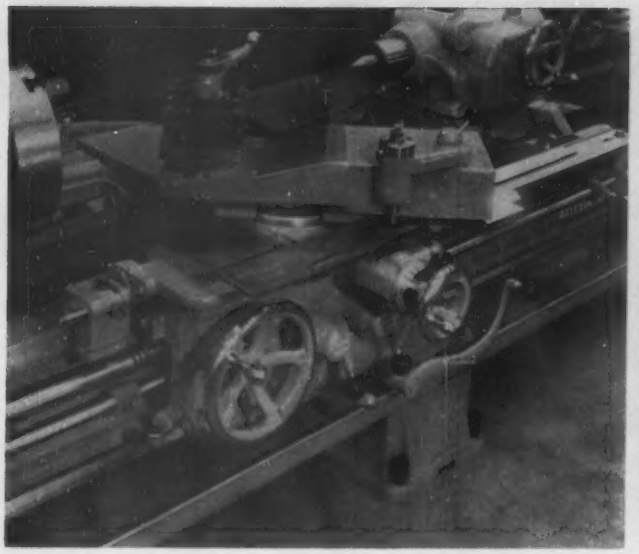
Pratt & Whitney, Division Niles-Bement-Pond Co, West Hartford 1, Conn

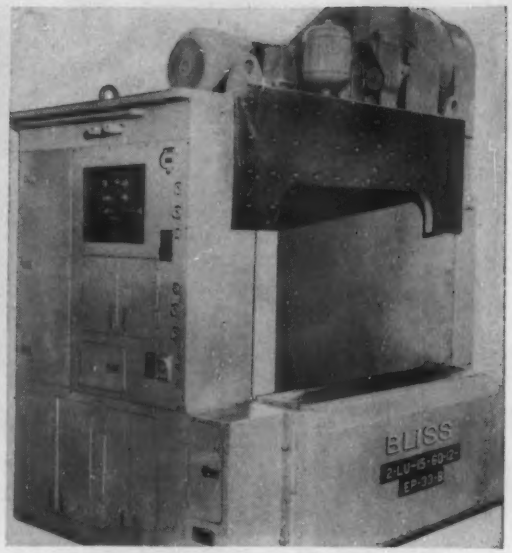
Cutting Attachments

Air Reduction announced new cutting attachments and new jet type mixer said to greatly extend the cutting, welding and heating range of Airco Style 800 general-purpose oxyacetylene torch. Jet mixer handles all welding and heating tip sizes with complete flame stability. Rubber sealing rings provide gas-tight seal with hand tightening.

New cutting attachments reportedly add versatility and cutting range to Airco 800 torch. Style 1800 cuts steel to 6 in. thick and Style 2800 to 8 in. thick. Standard cutting tips may be used for the attachments.

Air Reduction Sales Co, 60 East 42nd St, New York 17, NY





Hydraulic Tracer Unit For Axelson Lathes

Hydraulic Trace-O-Matic converts Axelson general-purpose lathes into contouring production machines in a few hours. Axelson states that it takes 15 minutes to revert to a standard lathe.

Parts are duplicated from flat templets, and the stylus exerts only a few ounces of pressure on the soft templet. Templets are made by turning in same machine through use of arbor provided with centers and slot equipped with setscrews to hold flat plate. Built-in micrometer adjustments for diameter and length controls are provided. Standard cross-feed dial allows diameter sizing in thousandths of an inch and thereafter templet automatically sizes other diameters and contours. Lengths are set to thousandths of an inch by graduated dial on templet holder.

All classes of work with uninterrupted cuts are handled automatically with Trace-O-Matic, including square or tapered shoulder, flanges, radii, tapers, grinding necks, form turning, step shafts, and contour facing. Close contoured tolerances can be maintained and the manufacturer states that finished dimensions of the work will be practically within tolerance built into templets.

Tungsten carbide tools of single point are preferred and held in indexing square toolpost which generally permits three roughing and one finishing tool to be brought quickly into position. An infinite number of operations can be performed from single setting of compound tool slide which can be set to any angle in 360°.

To allow a large range of contouring or utilization of a greater depth of templet without changing over from longitudinal to cross-feed, the tracer uses a long tracer slide stroke. Also, the short hydraulic hoses connecting the tracer slide do not move after the initial setup is made.

Axelson Manufacturing Co Div, Pressed Steel Car Co, Inc, 6160 S Boyle Ave, Los Angeles 58, Calif

Wire Grips Secure Filaments For Accurate Tensile Readings

Gripping fixtures for securing fine filaments for tensile tests have been designed for use on the Dillon Multi-Low-Range Tester.

Ordinarily, the strength of delicate materials is considerably impaired by necessity of clamping them firmly enough to exert desired test load. With these grips, however, full tensile stress is not brought to bear on filaments at clamping points, but only after they have been passed two or more times around self-aligning drums to assure perfect tests. Drums operate on free-swinging pivots so that a true vertical pull is exerted. Measurements of each fixture are 1-9/16 in. long by ⅝ in. wide by 17/32 in. thick; drum diameter is ½ in.

Testing machine can apply loads of from 0 to 300 lb. In addition to tensile, unit will perform shear, compression, and transverse tests with ASTM accuracy of ½ of 1% of indicated reading. Operational speed may be varied from 0 to 20 ipm. Permanent stress-strain graphs may be made with an easily attached recording drum, available as optional equipment.

W C Dillon & Co, 14630 Keswick St, Van Nuys, Calif

Welding Press Has Built-In Components

Welding press has all piping, controls and wiring located inside streamlined frame. Greater protection has been afforded to operating controls, although accessibility has been maintained.

Used for high-speed automatic assembly of large metal sections, presses are fabricated in four sizes with underdrive and conventional drive arrangements. Beds are 12 in. deep with widths ranging from 42 to 84 in. Strokes are 8 and 10 or 8 and 12 in.

The presses are available in two models, the 4LU and 4L series. For use in shops with limited headroom, the 4LU series is designed with the driving unit in the base. The 4L series has the driving mechanism on top of the press, and in this series the stroke can be changed without changing parts. In both series, the lower die, which is supported at four points, moves up to contact a stationary upper die.

The 4L has a bed 72x38 in., the 4LU, 69x29 in. Shut height is 44 and 30 in., respectively, with strokes per minute varying from 20 to 40 for the 4L and from 20 to 60 for the 4LU.

E W Bliss Co, 1375 Raff Road, Canton, Ohio

No. 609 all-purpose cutting coolant can be used interchangeably for stamping, punching, deep-drawing, tapping, and lathe work operations. Water-soluble product is said to protect steel from rusting for many weeks; cleans easily by any method.

Pillsbury Chemicals, 6545 Georgia Ave, Detroit 11, Mich

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MACHINES AND ATTACHMENTS

1 CYLINDRICAL GRINDERS—*Landis Tool Co, Waynesboro, Pa.* 28-page general catalog illustrates universal, plain, roll, centerless, and special purpose units for cranks, cams, pistons, valves, and similar parts. Descriptions and specifications.

2 HONING MACHINES & TOOLS—*Sunnen Products Co, St Louis 17, Mo.* Variety of bulletins bound in folder includes description of machines; case history booklet of typical applications; mandrel sets; external hones; portable hones; 37-page catalog on stones, mandrels, accessories; and 10-page price list.

3 AIR-POWERED DEVICES — *Mead Specialties Co, Chicago 41, Ill.* 52-page catalog illustrates products for use in forming automatic or semi-automatic production machines. Covers cylinders, clamps, presses, workfeeders, vises, valves, etc.

4 HYDRAULIC SURFACE GRINDER —*Thompson Grinder Co, Springfield, Ohio.* 7-page catalog C53 illustrates Type C units. Includes construction features and specifications, optional auxiliary equipment, clearance diagrams and charts.

5 THREADING HEADS—*Landis Machine Co, Waynesboro, Pa.* 8-page bulletin F-78-3 contains detailed data on solid adjustable heads, with tangential chasers; cover a pipe range from ⅛ to 6 in.

6 TURRET LATHE—*Cosa Corp, New York 17, NY.* 20-page bulletin Pirofa 45 illustrates Pittler (German) unit. Contains diagrams of workpieces and machine features, including simplified tooling and elimination of cross-slide. Attachments pictured and described.

7 ROTARY GEAR SHAVING — *National Broach & Machine Co, Detroit 13, Mich.* 16-page booklet presents essentials, basic principles, elements of machine operation, recent developments, diagonal shaving. Available units illustrated.

8 FLOATING HOLDERS—*Scully-Jones & Co, Chicago, Ill.* 6-page catalog on JT lock and eject collet holders. Advantages described, specifications and prices included.

● CARBIDE APPLICATION DATA—*Adamas Carbide Corp, Kenilworth, NJ.* Combination dial and slide chart, called Carb-A-Guide, indicates proper speed, carbide grade, tool angles, chipbreaker dimensions for feed and depth of cut, by turning dial to type of material to be machined. Includes speed conversion and milling feed slide, and hp computer. Price, $1; request direct from company.

TOOLS AND ACCESSORIES

10 JIG & FIXTURE COMPONENTS—*Lodding Inc, Worcester 1, Mass.* 86-page illustrated catalog describes expanded line including plain fixture keys, heavy duty jacks, and ductile iron bar knobs and speed handles. New sizes of standard components given, plus full-scale layouts of every fixture.

11 LUBRICANTS—*Keystone Lubricating Co, Philadelphia 33, Pa.* 8-page bulletin BK-20 covers specialized anti-corrosion materials. Application table and selector chart, characteristics, uses, specifications, case histories, included.

12 SLIDE RULE GAGE SELECTOR—*Sheffield Corp, Dayton, Ohio.* Selects proper pitch dias for all American or Unified thread plug or ring gages.

13 ACCESSORIES—*Erickson Tool Co, Cleveland 14, Ohio.* 34-page catalog K, Precision Tools, illustrates complete line of chucks, holders, mandrels, air cylinders, speed indexers, cutting bars, and special holding fixtures. Includes specifications, recommended uses, and production savings.

14 ABRASIVE & CUTTING TOOLS—*Metal Removal Co, Chicago 10, Ill.* 40-page catalog contains charts on selection, recommendations for specific jobs, operating speeds for wheel dias and tool overhang. Tool selection chart gives advantages, applications, operating speeds.

15 GRINDING & CUTOFF WHEELS —*Sandusky Abrasive Wheel Co, Kalamazoo, Mich.* 12-page catalog describes line of SAWCO rubber and resin-rubber bonded wheels, mounted points, and abrasive sticks and blocks, for all types of light grinding, polishing, deburring, and tool sharpening, and most cutoff applications.

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16 AIR GAGES—*Taft-Peirce Mfg Co, Woonsocket, RI.* 28-page catalog 613 on CompAIRator gages covers various types, illustrates inspection problems, includes specifications and size ranges of standard air plug, air ring, and air snap gage members.

HEAT-TREATING AND WELDING

17 HELIWELDING PROCESS — *Air Reduction Sales Co, New York 17, NY.* 16-page catalog 2300 covers features and equipment for tungsten arc welding process using an inert-gas shield of helium or argon or both for joining hard-to-weld metals.

18 TEMPERING — *Leeds & Northrup Co, Philadelphia 44, Pa.* 20-page catalog TD2-625 on Homo method contains operating results from five kinds of furnaces. Descriptions of typical installations illustrated, as well as specifications and data on control instruments.

PLANT SERVICE EQUIPMENT

19 AIR TREATMENT — *Westinghouse Electric Corp, Boston 38, Mass.* 40-page catalog 1620 on heating and ventilating, and 40-page 1630 on air-conditioning units, provide descriptive, performance, layout, engineering, and service data.

20 ELECTRICAL MAINTENANCE INSTRUMENT—*Parr Mfg Corp, Newark 5, NJ.* 7-page booklet describes Brunt Faultfinder for location of grounds in normally ungrounded electrical circuits. Illustrated data on purpose and operation of several models.

21 PROTECTIVE COATINGS & LININGS—*Arbonite Corp, Doylestown, Pa.* Special file folder contains data on Plastisol plastic coatings for prevention of metal corrosion, reduction of scratching, chipping, cracking, etc, of delicate materials and mechanisms. Current data will be supplemented periodically.

22 MATERIALS HANDLING EQUIPMENT—*Palmer Shile Co, Detroit 27, Mich.* 42-page catalog illustrates data on all type of equipment, including new products.

23 MOTORPUMP SELECTION—*Ingersoll-Rand Co, New York 4, NY.* 16-page Form 7123 is a slidefilm in printed form; provides description of centrifugal pump, and operation; selection factors for specific installation, problem solutions, material recommended for various requirements.

PARTS AND MATERIALS

24 HYDRAULIC COMPONENTS — *Hydraulic Press Mfg Co, Mount Gilead, Ohio.* 28-page condensed catalog 1101 contains four illustrated sections: pumps, motors, and power units; cylinders; valves; and hydraulic circuit cylinders.

25 TITANIUM TUBING — *Superior Tube Co, Norristown, Pa.* 8-page bulletin 42 presents properties, applications, advantages. Tube sizes of seamless and Weldrawn titanium listed; processing and fabricating characteristics discussed.

26 SETSCREWS—*Set Screw & Mfg Co, Bartlett, Ill.* 24-page catalog 19 contains description, technical data, prices, reference information on conventional and self-locking types, and general screw thread data.

27 HYDRAULIC VALVES — *Rivett Lathe & Grinder, Inc, Boston, Mass.* Catalog 260 illustrates data on line of subplate mounted, solenoid-operated units. JIC diagrams show flow operations for each of the 14 piston designs in which valve is offered.

28 MOTOR SELECTOR—*Reliance Electric & Engrg Co, Cleveland 10, Ohio.* 12-page bulletin B-2162 on squirrel cage induction units for applications ranging from 1 to 200 hp lists performance characteristics, construction features, dimensions, prices.

29 STAINLESS ALLOYS — *Cooper Alloy Foundry Co, Hillside, NJ.* Booklet consists of eleven reference sheets covering major alloys; gives chemical composition, mechanical and physical properties, corrosion resistance, machinability, heat treatment and weldability.

30 DURIA HARD METAL — *Duria-Werk, Karl Kempf K G, Neuss/Rh, Germany.* 72-page manual on powder metal. Covers range of applications, size tolerances, guidance for making tools, composition and characteristics. Additional booklet available on Durilit plastic casings for hard-metal-tipped tools.

31 CLUTCH - COUPLING UNITS — *Formsprag Co, Van Dyke, Mich.* 4-page brochure on new line provides dimensional data, service factors, and application engineering data necessary to specify correct unit.

32 ADHESIVES, COATINGS, SEALERS—*Minnesota Mining & Mfg Co, Detroit, Mich.* Pocket-size booklet contains list of 3M materials that meet Military, Army, Navy, and Federal specifications. Short description of end use is listed with each specification.

33 SPRING PIN — *Standard Pressed Steel Co, Jenkintown, Pa.* Folder illustrates Sel-lok units in variety of applications. Dimensions, shear strength, recommended max and min hole sizes to accommodate them provided.

34 HEAVY-DUTY AIR COMPRESSORS—*Joy Mfg Co, Pittsburgh, Pa.* 36-page bulletin A-72 on Series 100, Class WN-114 units, contains complete data on construction and operation. Seven models illustrated as single unit for displacement capacities from 1186 to 1948 cfm, as well as twin units which furnish up to 3896 cfm. Available with flange-mounted, V-belt, or direct connected drive.

MISCELLANEOUS

35 PRODUCTION SERVICE — *Sundstrand Machine Tool Co, Rockford, Ill.* 32-page booklet outlines service for small lots, long runs, and special turning jobs. Twenty examples illustrated.

36 PIVOT PUNCH SERVICES—*Pivot Punch & Die Corp, North Tonawanda, NY.* 20-page catalog illustrates complete services available. Examples of tools, dies, jigs and fixtures, special machinery, repair and rebuilding, are shown.

37 STEEL HARDENING— *C U Scott & Son, Inc, Rock Island, Ill.* 61-page brochure illustrates and describes Super Scottsonizing process for hardening stainless to estimated 2000 Bhn.

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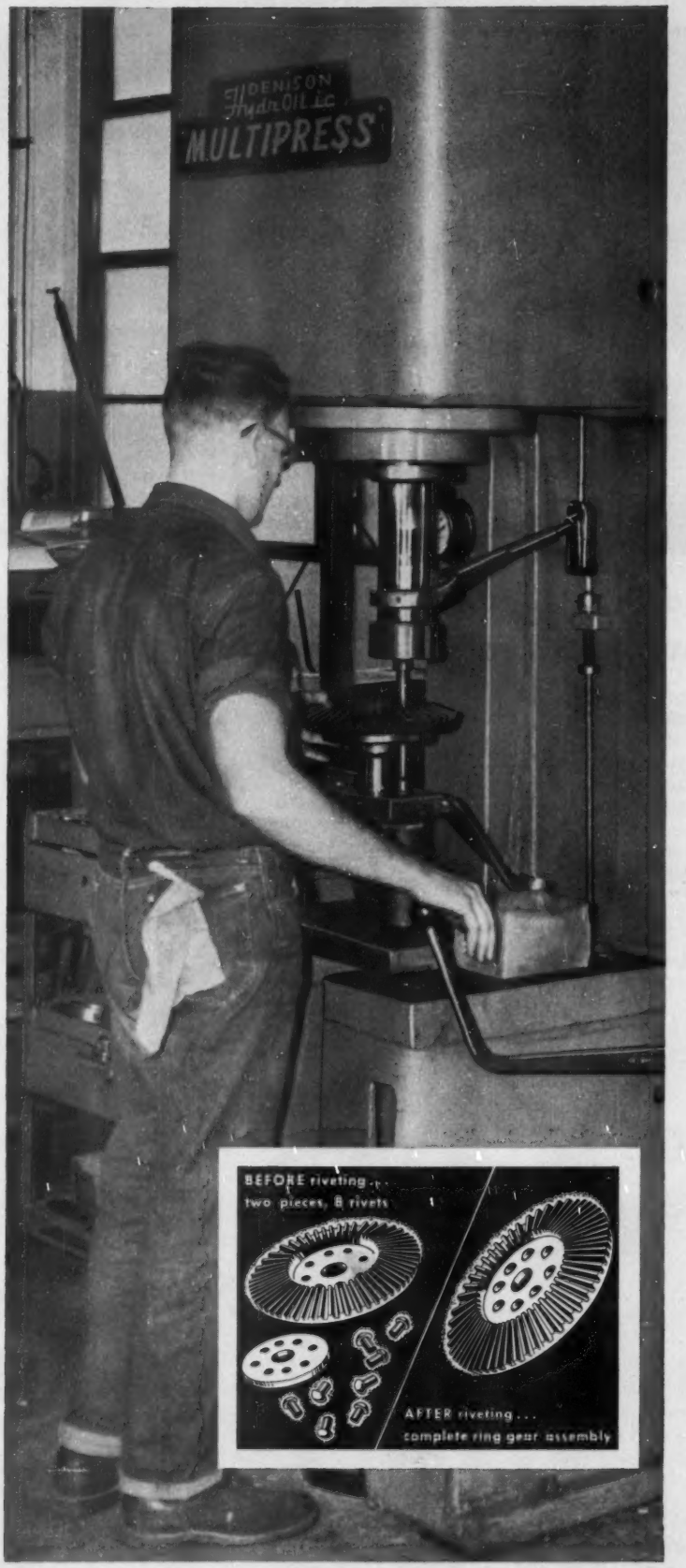


One man, one **DENISON MULTIPRESS**® . . . 9 times the production per man

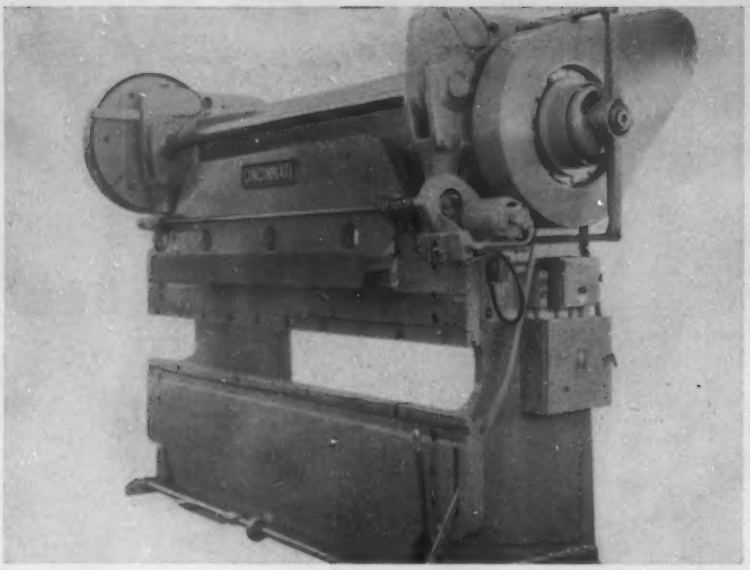
At Barber-Greene Company, they've tripled production for riveting together two halves of a ring gear assembly.

With former hot rivet method, the best a three-man team could do was 10 assemblies an hour. The operation was slow, noisy. Distortion from heat made a boring operation necessary.

With cold riveting, using Denison's hydraulic Multipress, flow of metal is better, more uniform. There's no heat, no warpage. One operator rivets 30 assemblies an hour.

You can get the same results. Send for bulletins and case studies on applications in the one to 75-ton pressure range. Write to: THE DENISON ENGINEERING COMPANY, 1164 Dublin Road, Columbus 16, Ohio.

DENISON *Hydr*OIL *ics*



Cincinnati High Speed Press Brake Does Punching and Automatic Feeding

Cincinnati all-steel press brake can be used for high-speed punching and automatic feeding applications. It operates at 70 spm and is equipped with a specially arranged ram.

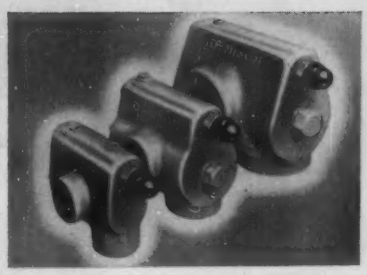
The machine has an all-steel rolled plate construction with an interlocked frame.

Pushbutton control is provided for ram adjustment with micrometer indicators included on both ends of the machine.

The design provides for centerline loading and weld-free joints. The brake is equipped with automatic pressure lubrication.

Among the additional features that are provided, there is a double hook tongue planed in the ram. The bed member is doweled to the housing at each end in order to withstand a stripping load when in operation of 20 tons.

The Cincinnati Shaper Co, Hopple, Garrard & Elam Sts, Cincinnati 25, Ohio



Relief Valves for 2000 psi Service

Line of low-cost relief valves is designed for efficient pressure control in 2000 psi hydraulic circuits. Units are light and compact in construction, furnished with threaded bodies for in-line or T'd connections. They are available in pipe sizes of ½, ¾, 1¼ and 1½ in., and may be vented or operated by remote control.

Pressure regulation from 100 to 2000 psi is available in the ½, ¾, and 1¼-in. sizes. Pressure settings from 150 to 2000 psi are possible in the 1½-in. size. Variations in line volume have little effect on opening or closing. Pressure settings are regulated by adjusting a single screw. A removable acorn nut covers the pressure screw for positive oil seal.

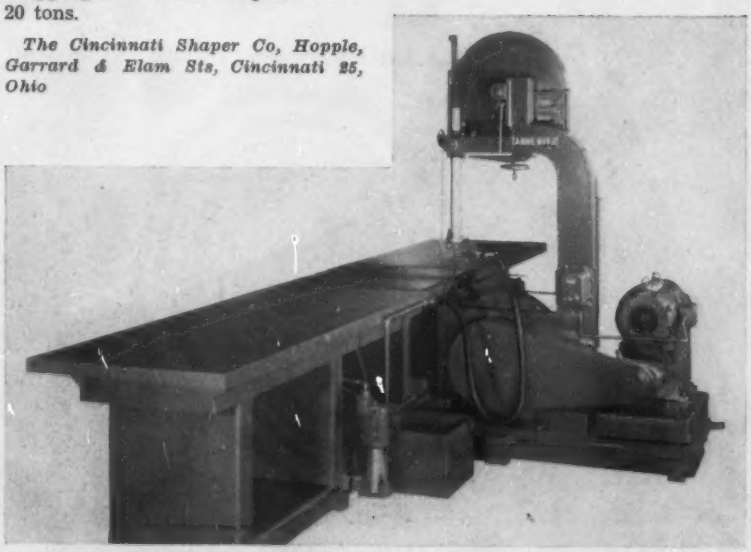
The Denison Engineering Co, Columbus, Ohio

Eriez Magnetic Grate For Variety of Hoppers

Eriez reports development of a permanent magnetic grate of flexible basic design so hoppers of virtually any shape can be easily and accurately fitted. It consists of series of stainless steel cylinders covering Alnico magnetic elements, spaced and held in position by thin welded stainless strips. Parallel with cylinders and centered between them are ½-in.-square steel grid bars, also welded to the strips.

Installation is effected by placing magnetic grate in hopper, ends of cylinders resting against its sides. Unit is centered by adjusting screws. In operation, grid bars act as baffles to deflect material onto magnetic clinders. Excessive speeds of materials are controlled by this design.

Eriez Mfg Co, Erie, Pa

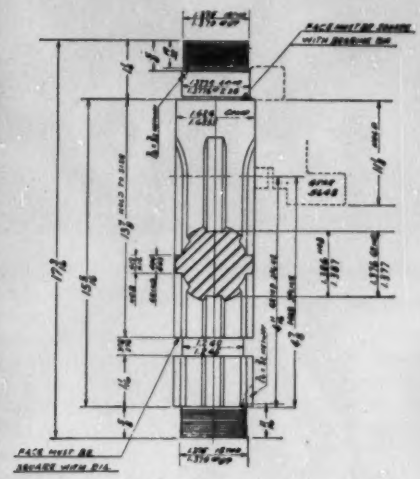


BANDSAW designed for cutting sections of cellulose acetate can also be used for steel and aluminum structural members. It is a 30-in. variable-speed bandsaw running at any speed in ratio 6:1, mounted on sliding base with 30-in. travel, hydraulically operated. Machine advances towards table with sawblade which is given a 90° twist entering slot in center table. Rate of travel is 0 to 8 ips. Table is 43 in. deep and 27 in. of clearance are provided between table and upper guide. Coolant pump and tank are standard equipment as are automatic two-wheel brakes — *Tannewitz Works, Grand Rapids, Mich*

here's FACTUAL EVIDENCE from TIME SHEETS OF THE FOSDICK MACHINE TOOL CO. CINCINNATI

EXAMPLE No. 1

TURNING SHAFT—BACK GEAR



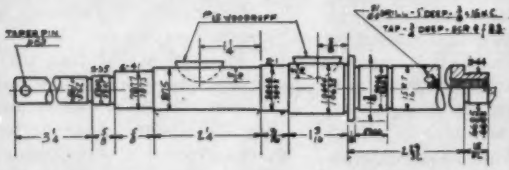
Old lathe time.....28 minutes per piece

Sidney Lathe Time.....18 minutes per piece

TIME SAVED 10 MINUTES PER PIECE

EXAMPLE No. 2

TURNING SPRING DRUM SHAFT



Old lathe time.....90 minutes each

Sidney Lathe Time.....30 minutes each

TIME SAVED..... 60 MINUTES EACH

SIDNEY FLUID TRACER LATHES

CUT WORK TIME TO FRACTIONS

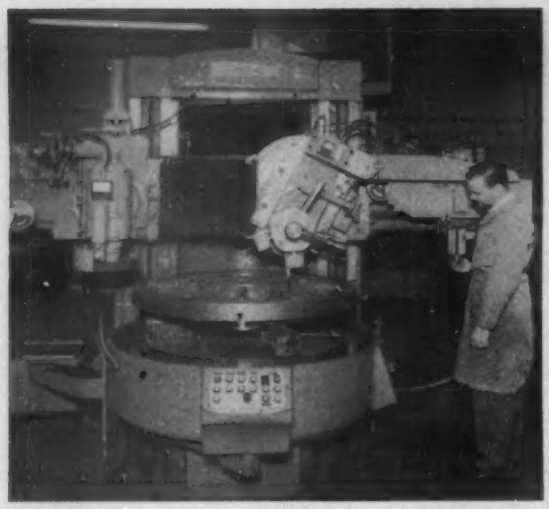
TIME COSTS MONEY . . . SAVE TIME AND MONEY WITH SIDNEY TRACER LATHES . . .

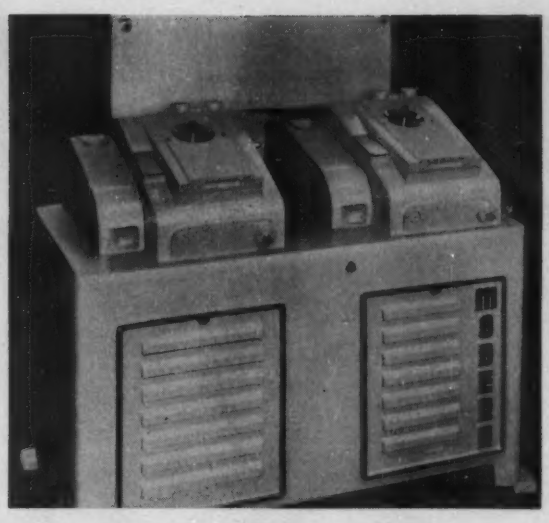
the tracer imparts all impulses to the various operating units as it follows along a template or master piece. These units function automatically to reproduce the work in any quantity... the more work produced, the more time and money saved.

Write for bulletins

THE SIDNEY MACHINE TOOL CO. • SIDNEY, OHIO

Builders of Precision Machinery since 1904





Turning and Grinding Machine Performs Multiple Operations

Precision turning and grinding machine developed for the jet engine industry is applicable to any work on which exceptional tolerances are required on concentricity and parallelism of turned and ground surfaces. This 3100 Series machine includes four table sizes of 36, 42, 48, and 52 in., all with a 60-in. swing.

Power for driving the worktable is provided by 10-hp dc drive unit with power transmitted to table spindle through timing belt. Work spindle pulley is ball-bearing mounted in heavy housing bolted to lower area of base. The table is bolted to a large-diameter flange on the spindle. Spindle assembly is a self-contained unit consisting of spindle carried by extra large, preloaded anti-friction bearings in the spindle housing.

Right-hand compound mounts a hydraulically actuated turret slide equipped with cam-locking manually rotated five-station tool turret. Turret slide can be rotated 45° either side. Non-metallic surfaces of cross-slide bear against scraped cross-rail surfaces.

Left-hand compound is equipped with direct-connected, self-contained grinding spindle capable of an 8-in. hydraulically actuated vertical stroke, plus 4 in. of manual adjustment. Max angle setting of compound is 45°. Grinding spindle itself can be swiveled through 180°.

DC drive provides infinitely variable electronic potentiometer-controlled table speed up to 175 rpm. Dynamic braking of table and jog button control are standard equipment. All horizontal and vertical feeds are hydraulically actuated to provide infinitely variable feed rates. Controls for feeds are grouped at either end of cross-rail with all other controls located in panel at front center of machine.

Optional equipment includes a variety of grinding spindle designs. Hydraulically actuated straight, radius and combination radius-angle dressers are available. Also optional is the Frauenthal fpm control, an electronic device that automatically compensates table speed to maintain constant surface speed when taking wide facing cuts.

Frauenthal Div, Kaydon Engineering Corp, Muskegon, Mich

Sheet-Blasting Machine Improves Finish

Pangborn ES-503 Rotoblast machine cleans steel sheet and plate up to 54 in. in width at production rate of 20 to 80 lineal ft per min. It is capable of cleaning in excess of 200 sq ft of surface per min. It is equipped with two Rotoblast wheels which throw 160,000 lb of abrasive per hour.

Machine has been designed to take plate into blast chamber automatically, blast surface, and remove all abrasive before it is discharged. Cleaning operation is accomplished by means of blow-off fan which deposits abrasive in spiral conveyor. It is moved to elevator which carries it through abrasive separator and reclaimer for recycling. Standard equipment is two 195-5 RG wheels, but machine can be ordered with smaller sized wheels where production requirements are lower. Machine is reported to improve finish on sheet steel, provide a better binding surface for paint, and allow cost reduction through use of hot-rolled rather than cold-rolled sheet.

Pangborn Corporation, Hagerstown, Md

Gear Deburring Machine Provides High Production

Two-station universal gear deburring and chamfering machine (Model BME-24) handles all spur and helical gears, as well as straight and involute external splines, from ⅝ to 6½-in. pitch diameter.

Two stations can be tooled to perform: identical operations at both stations; successive steps on the same gear; or to debur and chamfer parts that are totally different. Machine operates continuously, chamfering entire tooth form in one-fifth of a second.

Tooling at each station consists of a demountable pilot gear, tool block, and form cutter. Precision tooling is developed on master machines at the Modern plant. Two-way keying and socket screws facilitate positioning. Modern states that an unexperienced operator can normally retool each station in ten minutes.

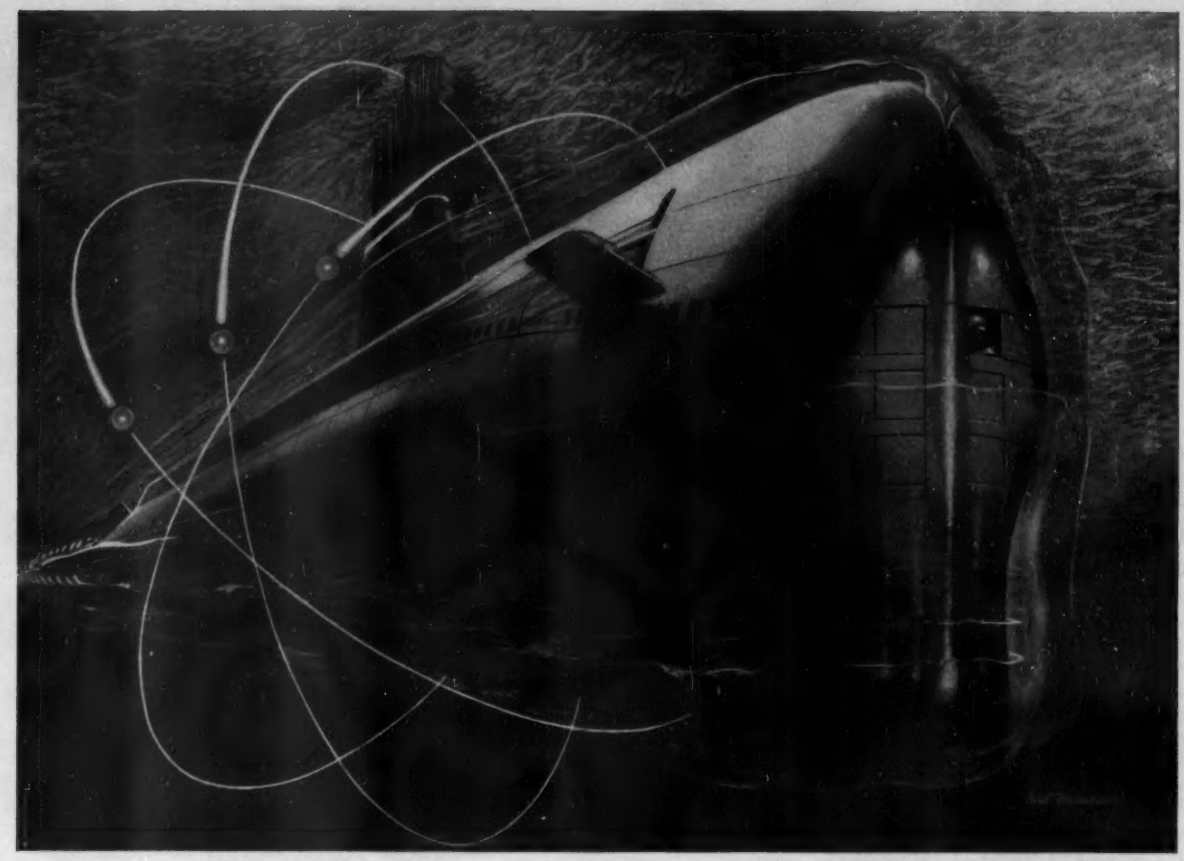
Special Modern form cutters can be removed for sharpening with ordinary shop tools. Since the form cutter is ground along its full length, it is reset simply by butting its ground face against a preset stop block. All moving parts are enclosed.

Modern Industrial Engineering Co, 14230 Birwood Ave, Detroit 38, Mich

Dual Tools

Double-purpose weld cleaning tools are reportedly made more durable and easier to use. Brush is pitched at angle to handle, and frame which holds brush and handle is of heavier gage steel and ribbed for additional rigidity. Chisel is welded to frame and handle instead of riveted.

Atlas Welding Accessories Co, 707 E Lewiston, Ferndale, Detroit 20, Mich



ATOMIC SUB BUILDERS

Rely on World's Greatest Lubrication Knowledge and Engineering Service

AFTER 54 years of building over 300 "conventional" submarines for the U. S. Navy and our allies, Electric Boat Division, General Dynamics Corp., marks its entry into the atomic age with the launching of the "Nautilus"—world's first atomic powered submarine.

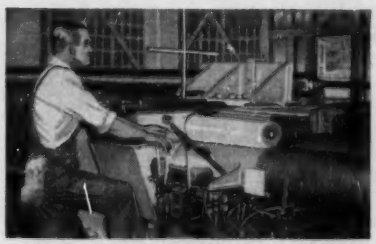
Electric Boat, with its sprawling foundries and shops along the Thames River at Groton, Conn., is really many industries in one. It casts its own metals—both ferrous and non-ferrous. It shapes and machines metal parts—from thick armor plate to parts with microscopic tolerances. It has 27 overhead cranes, marine railway and land railroads, a fleet of trucks, low- and high-pressure compressors, its own Diesel power plant.

This wide variety of costly machinery represents almost every lubrication condition found in modern industry. That is why Electric Boat relies 100% on Gargoyle lubricants and a program of Correct Lubrication—has done so for 34 years.

★ ★ ★

You can give your plant, mine or mill this same unsurpassed protection. Just call your Socony-Vacuum representative.

A snorkel intake tube being machined to very precise tolerances on one of the large lathes in the Groton plant.



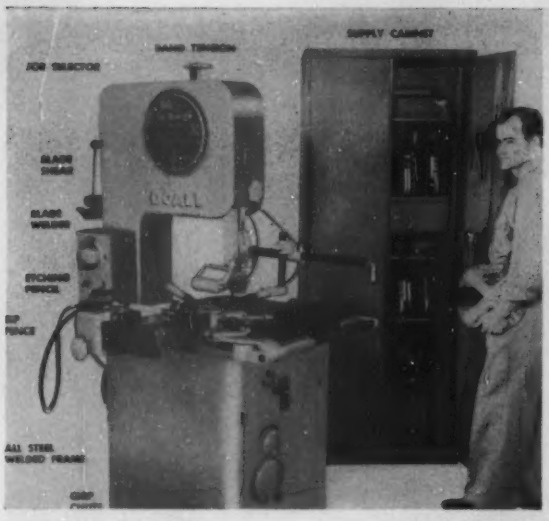
Hydraulic bender shapes section of 8-in. steel pipe in two minutes. This operation formerly took a full day.

SOCONY-VACUUM *Correct Lubrication*

FIRST STEP IN CUTTING COSTS

SOCONY-VACUUM OIL CO., INC., and Affiliates: MAGNOLIA PETROLEUM CO., GENERAL PETROLEUM CORP.

SOCONY-VACUUM



DoALL Band Machine Offers Wide Versatility

Designed for versatility is this line of 16-in. band machines with 12-in.-thickness capacity. Numerous attachments allow tailoring of machine to meet individual needs. Units are powered for tough, straight, or curved metal sawing operations and are more than adequate for sawing woods, plastics, and other materials. They can be arranged for band filing, metal polishing, and carbide finishing as well as slicing of hundreds of other materials by applying proper DoALL band tool, tool guides, and use of attachments and accessories built for the machine. In addition, carbide tools can be finished.

DoALL states that the construction reflects the same heavy-gage steel and welded box frame design found in their most expensive models. Trunnion and cradle support 24x24-in. worktable which tilts 45° to right and 10° to left. Saw blade welder handles blades up to ½-in. width. Machine is equipped with standard DoALL saw guides which can be interchanged with six other types for specialized sawing, including 90° guides for cutting off long pieces. Lower guide can be located above table surface for trimming operations.

The carbide-tool finishing unit is one of twenty different attachments available. It finishes single point carbide tools with surface finish equivalent to that obtained with diamond wheels, according to DoALL. A similar band polishing attachment is available that makes possible deburring and finishing of small parts. Another attachment adapts this band machine to band-filing with wide range of flat, oval, and round files of different sizes.

Attachments may be procured for circle cutting, mitering, cutoff work, ripping, friction sawing, and handling heavy work. Several types of work-feeding units can be selected, including a power work feed, screw-and-ratchet work feed, and work-holding jaws. For work illumination, two types of table lamps are available as well as illuminated magnifying attachment. Coolant and chip disposal facilities, blade shear for saw welder, etching pencil, and supply cabinet are additional accessories.

The DoALL Co, 254 North Laurel Ave, Des Plaines, Ill

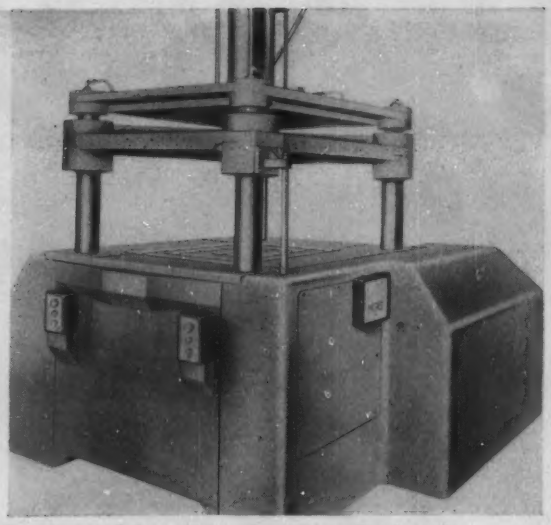
High-Impact Multi-Purpose Resin Introduced by Borg-Warner

High-impact thermoplastic styrene-type resin, called Cycolac, was developed and is now being produced by Marbon Corp, a Borg-Warner subsidiary. It has the toughness of rubber and the surface hardness of most metals.

The resin is reported to be so shatterproof that it can be molded into golf club heads, so heat-resistant that it can hold boiling water, and so soluble that it can be sprayed in colors on elastic rubber surfaces, but won't chip off.

Marbon further states that Cycolac is characterized by its capability of being made in bright colors, its good resistance to chemicals, light weight, outstanding electrical properties, fine gloss, and its solubility in selected solvents for potential coating applications. The resin is described as being ideal for milling, calendering, extruding, injection molding, and post-forming.

Borg-Warner Corp, 310 S Michigan Ave, Chicago 4, Ill



Trimming Press Designed To Use the Brehm Die

Trimming press was designed to use the Brehm trimming die more efficiently. It is 8 ft high and takes up less than 22 sq ft of floor space. The press does not have or need the size and power necessary for forming presses, using only power and time required for particular shell that it is trimming.

By changing cutter adapters, the press can be set up to trim shells of any size and shape up to 16 in. square and 6 in. deep. Thickness of material can vary up to 0.125 in., depending upon size of drawn shell.

Machine is mechanically operated, controlled by two pushbutton switches which require two-handed pressure through closing cycle. Ram stroke is 15 in., and time for complete trimming cycle is about 4 sec.

Brehm Division, The Steel Products Engineering Co, Springfield, Ohio

Floating Holder Ejects Tools Without Drift

Scully-Jones announces series "JT" lock-and-eject floating holders for taps and reamers. Threaded nut on holder nose revolves on ball bearings to lock 4-split chucks for taps and 2-split chucks for reamers. Chuck draws up and closes as nut is rotated. Float is provided by double-gear spline drive, which compensates for misalignment between tool and work on multiple-spindle operations.

Scully-Jones & Co, 1901 S Rockwell St, Chicago 8

Revere Extruded Shapes help increase ELECTRIC GENERATOR OUTPUT

(perhaps you, too, could use our shapes to your advantage)

Model section of G.E. direct-cooled rotor for turbine-generator. Note intake scoop at left front, hollow copper conductors of extruded shapes, in center, exhaust outlet at right rear.

Insert shows typical extruded shapes after milling by G.E. to provide circulation of hydrogen throughout the field coils.

Winding temperatures are an important limitation upon the output of electric utility generators. They must be kept within safe limits to avoid damaging the insulation. Hence all generators have some method of cooling. Conventionally, the heat passes from the copper conductors in the rotor, through the insulation (which presents a formidable barrier to heat transfer) to the steel parts of the rotor body, and air or hydrogen is pumped through and around the rotor. It was realized long ago that more effective cooling could be obtained if some way could be found to remove the heat directly from the rotor coils.

Some years ago generator engineers of the General Electric Company, Schenectady, New York, proposed making each turn of the rotor coils of two copper extruded shapes; one a channel, the other comb-like. Fitted together, they would make hollow passages for the hydrogen, which would be taken in through scoops on the surface of the rotor, and exhausted through outlets some distance away, also on the rotor surface. In that way, the rotor could be quite uniformly and more effectively cooled throughout its length, and output greatly increased in relation to the physical dimensions of the generator.

An important problem was found in the extruded shapes. Design requirements had to be adjusted to the opportunities and practicalities of the extrusion process. Today these copper shapes, 20 feet long, drawn and finished to strict specifications as to dimensions and straightness, are making it possible to remove four times as much heat as conventional systems, and to double the generator output with no increase in size... For full information on extruded shapes, see the nearest Revere Sales Office.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

• • •

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities, Distributors Everywhere.

SEE "MEET THE PRESS" ON NBC TELEVISION, SUNDAYS

Knife Grinder Works at High Speed

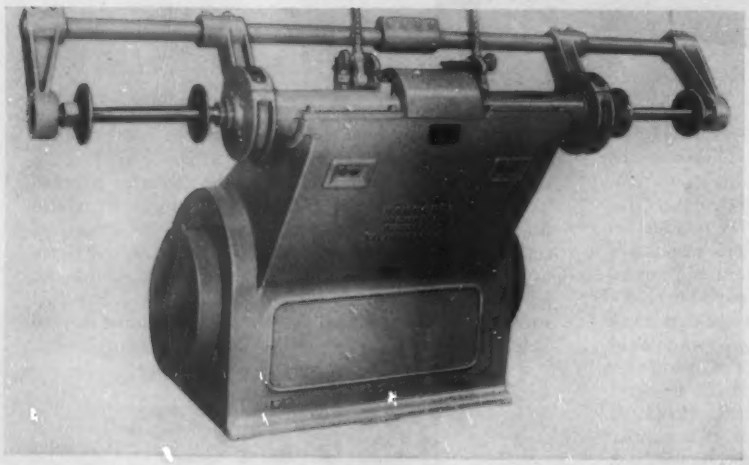
Machine for grinding the bevels of all types of straight knives and shear blades particularly grinds chipper, hog, and barker knives and all types of heavy-duty shear blades.

Heavy cuts are possible at a high rate of table travel and using a large volume of coolant on the workpieces.

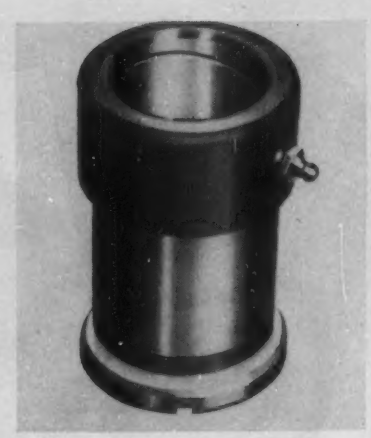
The machine featured a 60-in.-dia segmental grinding wheel with 5-in.-dia precision-ground grinding wheel spindle mounted in extra-heavy-duty pre-loaded precision Timken bearings. The automatic infeed incorporates hydraulic cam-actuated control mechanism with graduated dial in increments of 0.005 in. In addition to the automatic infeed, there is a large manually operated handwheel.

Knife bar is mounted on rugged table which is hydraulically operated with table travel speeds ranging from 10 to 100 fpm. Machine is equipped with motor for grinding wheelhead assembly recommended from 30 to 100 hp. Spindle is driven through sheaves using multiple of six large V-belts for positive drive operation.

Hanchett Manufacturing Co, Big Rapids, Mich



POLISHING AND BUFFING LATHE, wide swing Model RRO, is a two-spindle lathe, each spindle with its own motor, motor control, and V-belt drive. Each spindle runs in three ball bearings, one in the end of the spindle which is part of the special outboard bearing assembly. Heavy-duty construction and rigidity of outboard bearing permits use of wheels up to 16-in. face. Machine is especially suited for polishing and buffing large and irregular shaped parts either by hand polishing or in conjunction with semi-automatics — *Hammond Machinery Builders, Inc, 1618 Douglas Ave, Kalamazoo, Mich*



Guide Bushings

Lamina guide bushings are made of hardened steel with 0.002 to 0.004 in. of bronze electroplated on inside dia. This combines long-wearing service of steel with smooth action of bronze to eliminate seizing, scoring, and out-of-round wear characteristics. In addition to bronze-plated inside diameter, bushings have oil groove 5/32 in. wide machined into inside wall in a figure eight pattern.

Bushings are wring-fit in die shoe securely held by three different types of retainers. Illustrated above is nut-type bushing with nut located in counterbore for flush assembly. It is available for pins with 1 to 2-in. nominal diameter. Other types include toe-clamp bushing for pins ranging from 2 to 3 in., and ring-clamp-type bushing for heavy-duty operations with pins 2½ to 3 in. in dia.

Guide pins are made of water-hardened tool steel, ground and polished, and are said to eliminate brinelling and mushrooming characteristics of case-hardened pins when driven into die shoe. Three types include: straight pin, 1 to 3-in. dia, shoulder pin, 1 to 2½-in. dia, and removable pin, 1 to 3-in. dia.

Lamina Dies and Tools, Inc, 14925 W Eleven Mile Road, Berkley, Mich

Machining Lubricant

Oil-base water-soluble machining lubricant for mist applications, Vantrol 5641C, is said to have low ph factor and neutral odor. Product test reports slotting 12-ft-dia gear of 4140 steel with Brinell hardness of 240. Vertical slotter cut with a ⅜ in. wide tool at 8 sfpm with feed of ¼ in. stock removal per pass. Tool life was increased from 30 slots per grind to 180 slots.

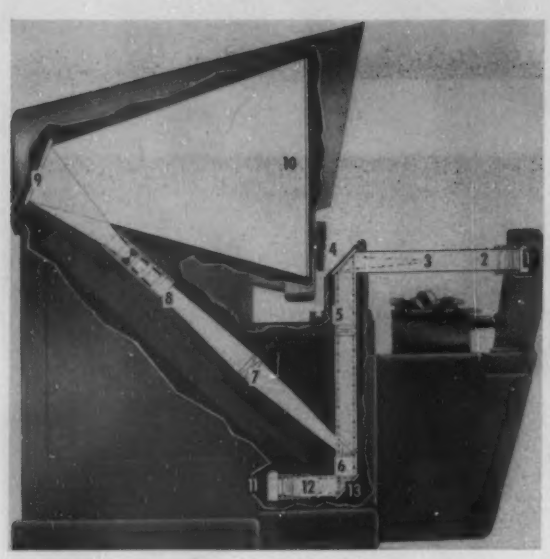
Van Straaten Chemical Co, 546 W Washington Blvd, Chicago 2, Ill

SNYDER SPECIAL

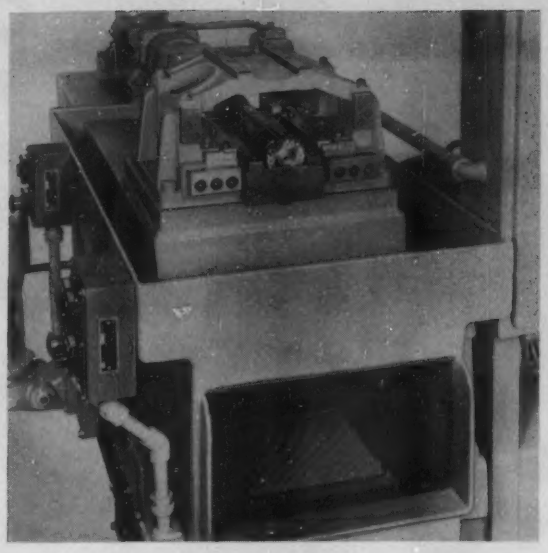
17-STATION, AUTOMATIC LINE TRANSFER
WITH OVERHEAD INDEX
MILLS, DRILLS, CORE-DRILLS, SPOT-FACES
REAMS AND TAPS
320 EXHAUST MANIFOLDS AN HOUR
AT 80% EFFICIENCY

SNYDER

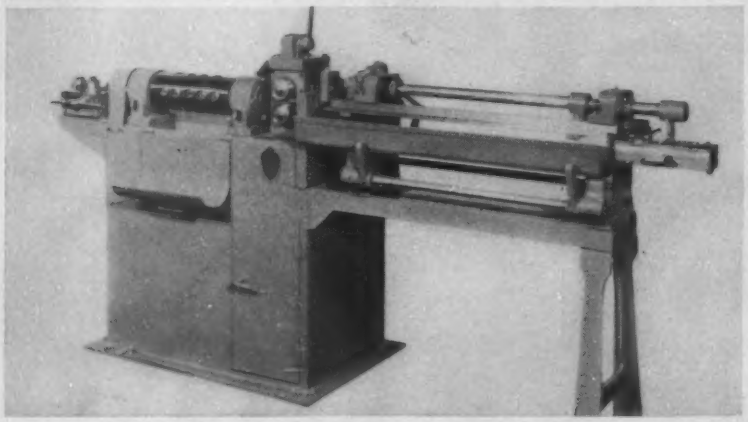
TOOL & ENGINEERING COMPANY
3400 E. Lafayette, Detroit 7, Michigan
29 Years of Successful Cooperation with Leading American Industries



CONTOUR PROJECTOR with 30-in. viewing screen is for use in precision micrometry and on production lines. Staging area has 17-in. throat and table travel of 8 in., horizontally or vertically, is provided. Helix table has rotation of 15° in either direction; horizontal and vertical micrometers read to 0.00005 in. over 1-in. range; angular vernier is calibrated for two minutes of arc. Projector has choice of six lenses with from 10 to 100x magnification. Switch provides choice of shadow or surface illumination. Changes in magnification are made without refocusing—unvarying 8-in. distance between lens and plane of object is provided — *Eastman Kodak Co, Rochester 4, NY*



LOCATING FACES on automotive bearing caps are broached at 480 per hour with this semi-automatic machine featuring two adjustable stationary insert-type broaches. Model HB1 is a 4-ton machine with 12-in. broaching stroke traveling at 30 fpm; max return speed is 60 fpm. Three caps of different sizes are machined, using a fixture which does not clamp the part, but guides it as it is pushed past the stationary broaching teeth by the ram. Two of the caps are broached with fixture located as shown—by removing four holddown bolts, fixture is inverted for thickest bearing cap—*Colonial Broach Co, Box 37, Harper Station, Detroit 13, Mich*



Rotary Machine Straightens And Cuts Off Wire

Machine removes waves, bends, and kinks from 1/16 to ¼-in.-dia wire and cuts lengths up to 40 in. at rate of 125 fpm. Extensions can be furnished to cut lengths to 12 ft.

Wire is hand-fed into series of three-roll pre-straighteners which directs wire through straightening arbor. Wire enters two-roll feed housing which feeds it into guide bar where it is gaged and cut to length. Desired lengths are cut by positive stop gage automatically actuated by release mechanism.

Drive is supplied by 5-hp, 1800-rpm motor and transmitted by V-belt to jack shaft from where it is transmitted by roller chain drive to the flywheel. Feed and speed of machine can be fitted to user's requirements.

Anti-friction ball and roller bearings are used, and all main bearings run in enclosed oil bath. Variations of standard models are available to meet special requirements.

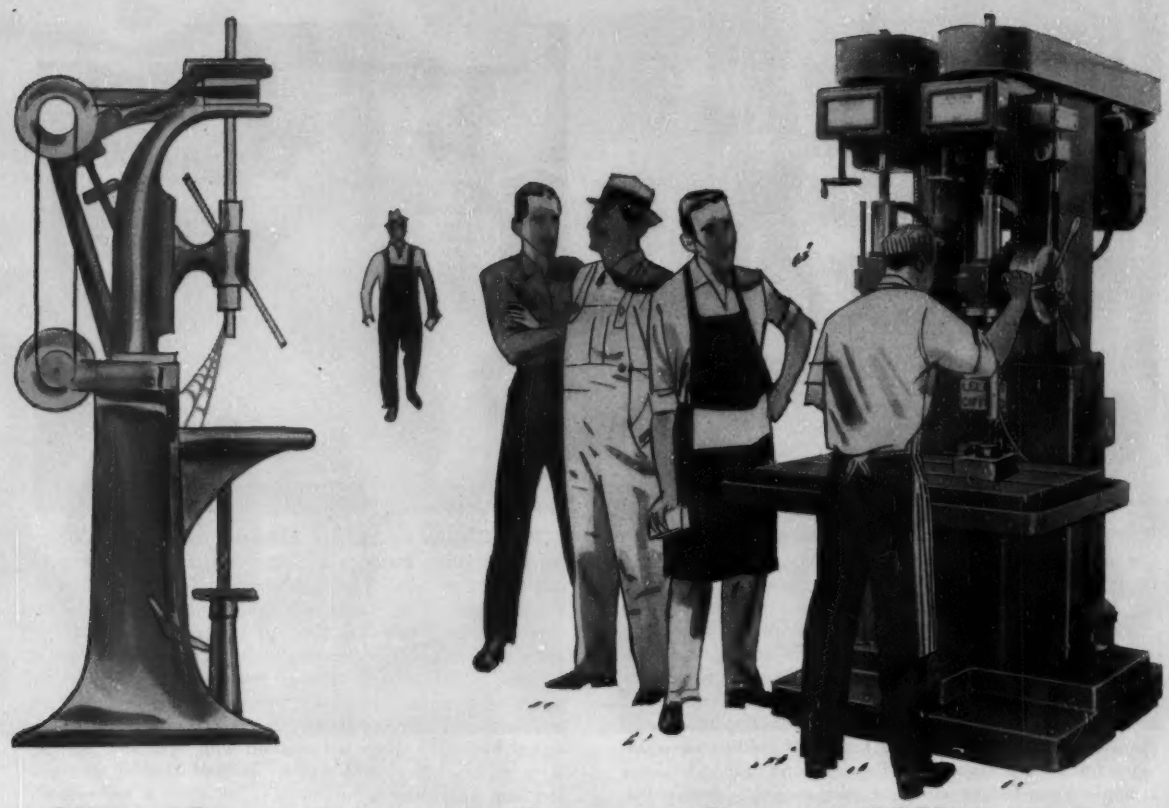
The G C Patterson Machine Co, 3409 Trumbull St, Cleveland 15, Ohio

Bronze Electrode From Eutectic

Bronzochrom electrode, EutecTrode 1850, has been developed for high strength joining and for frictional and corrosion resistance on wide variety of base metals. It produces copper base deposits alloyed with silicon, manganese, and chromium which increase tensile strength and give additional resistance to wear and corrosion. Special formulated flux coating with strictly controlled rate of disintegration is said to restore to the deposit elements lost across the arc.

Electrode is recommended for joining and overlaying steel, cast iron, and copper alloys. It is said to be excellent for various combinations of ferrous and non-ferrous metals including stainless steel, nickel and nickel alloys. It is reported harder and to be five times as rapid to apply.

Eutectic Welding Alloys Corp, 40-40 172nd St, Flushing 58, NY



It's time to weed out the wallflowers

When operators stand in line to use a new Leland-Gifford Drilling Machine rather than the old belt driven model (it actually happens), it's time to check up.

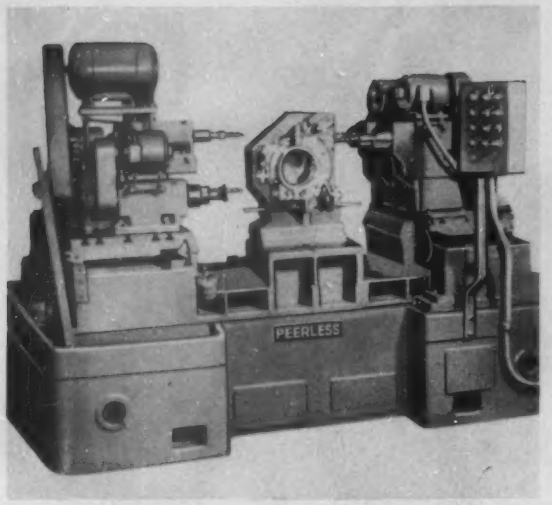
You'll find plenty of good reasons for their choice. First of all, new Leland-Gifford Machines are easier to use. With convenient central controls, reduced work handling, more speed and built-in safeguards against costly errors, the average operator can *greatly increase machine production* with no more effort on his part. With the added advantage of higher precision, he can do *better* work, too.

If drilling machines in your plant are turning into "wallflowers", it will pay you to look into the complete line of modern Leland-Gifford Motor Spindle Drilling Machines. Write for complete information or call the office nearest you.

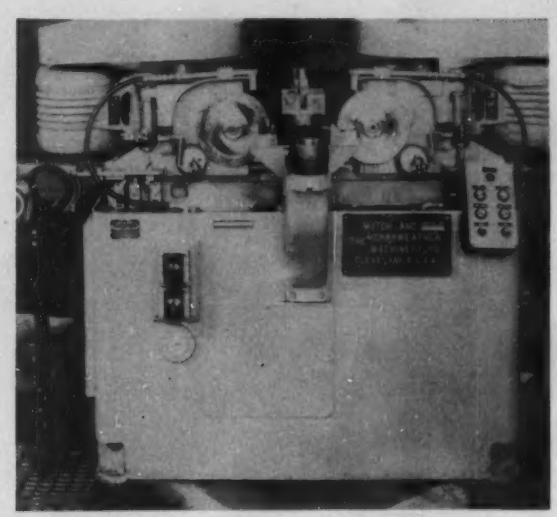
SAVE DAYS — CONTACT THE OFFICE NEAREST YOU

LELAND-GIFFORD
Drilling Machines
WORCESTER 1, MASSACHUSETTS, U.S.A.

- **CHICAGO 45**
  2515 West Peterson Ave.
- **DETROIT**
  10429 West McNichols Rd.
- **CLEVELAND 21**
  P. O. Box 217
- **NEW YORK OFFICE**
  75 South Orange Ave.
  South Orange, N. J.
- **LOS ANGELES OFFICE**
  2620 Leonis Blvd., Vernon 58, Cal.
- **INDIANAPOLIS 6**
  P. O. Box 1051
- **ROCHESTER 18**
  P. O. Box 67, Roselawn Station



PUMP HOUSING ASSEMBLIES are processed by this double end precision boring machine which features hydraulically actuated cross-slide and power-operated mechanical take-off device which also clamps slide in position during machining cycle. Positioning device permits boring of close-center-distance holes in single setup. Machine performs boring, chamfering and trepanning operations to precise specifications. Thirty pump housing assemblies are processed in this manner in a single hour at 100% efficiency. All special perishable tools and holders were designed and manufactured by Peerless, and tooling features a single-place fixture with manual clamping — *Peerless Production Co, 19451 Glendale, Detroit 23, Mich*



CONNECTING RODS are handled by machine which takes one-piece forgings and saw-cuts cap from shank of rod. Machine consists of righthand and lefthand sawing heads mounted on hardened steel ways with saw-heads carrying HSS triple-chip, circular saw blades fed by hydraulic cylinders simultaneously from each side. Part is located in fixture by machined pin end and clamped by hydraulic cylinder over top of forging at crank end. Right and lefthand saw-heads are driven by 2-hp motors. External hydraulic sump is furnished with hydraulic pumps, 2-hp motor, valves and piping. Beyond loading and unloading, operation is automatic — *The Motch & Merryweather Machinery Co, West Third & Lakes'de Ave, Cleveland, Ohio*

Welding Accessories Include Five Products and Processes

Arcos has introduced a new method of packaging electrodes, a new flux for submerged arc welding of stainless, a new line of specialty stainless steel wire, a new weld insert for welding stainless pipe, and a newly developed line of products for welding aluminum.

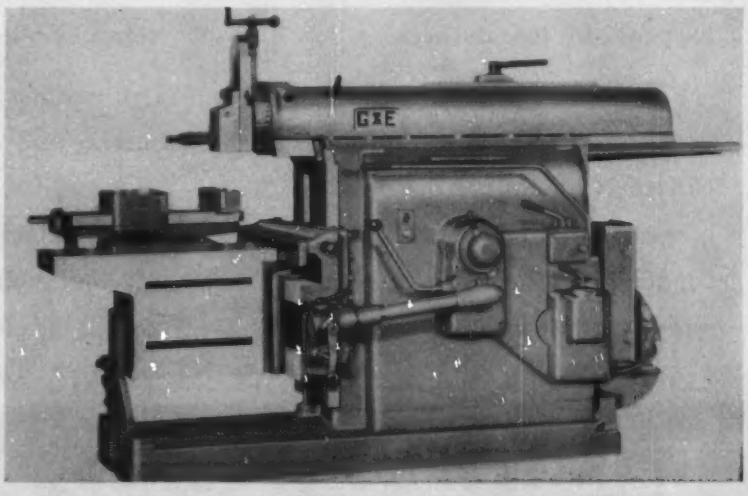
The packaging method uses a container known as Electropak, opened simply by stripping tape and lifting metal lid. A sheet of aluminum foil between outer and inside walls prevents moisture pickup.

The submerged arc welding process for stainless and alloy steels combines a flux known as Arcosite flux, with a stainless steel wire called Chromar. Use of the flux and wire together is designed to give metallurgically controlled weld metal compositions. Arcosite flux is suitable for welding chromium-nickel stainless steels, the straight chromium stainless steels, and the chromium-molybdenum stainless steels.

Line of stainless steel wires was developed for welding chrome nickel, straight chrome, or chrome-molybdenum steels. The new wire is used with submerged arc, inert gas, oxyacetylene, or atomic hydrogen methods. It is available in 17 different compositions.

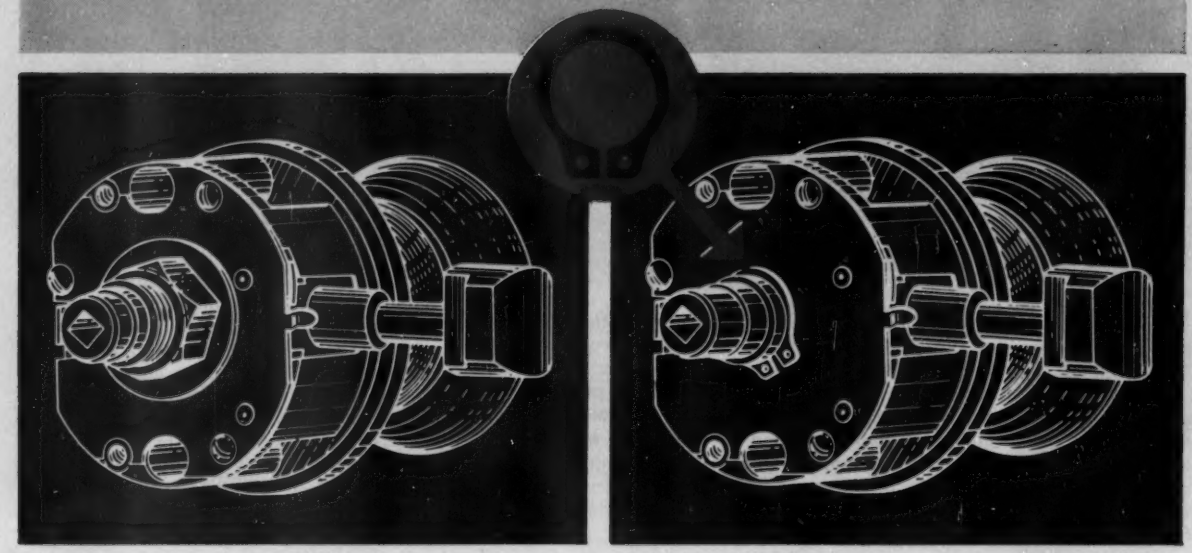
The weld insert is used in a process which completely fuses it by conventional inert-gas, shielded-tungsten-arc torch to permit deposition of a root pass which is smooth and uniform on both sides, even though welding is done on one side only.

Arcos Corp, 1500 S 50th St, Philadelphia 43, Pa



CHROME-PLATED RAM V-WAYS are provided on all G&E shapers. The ways are machined and chrome directly applied by precision plating to uniform thickness of 0.001 in. Guideways in frame are scraped for proper bearing and lubrication. Hardness of chrome plating is $70R_C$ — *Gould & Eberhardt, Inc, Fabyan Place, Irvington 11, NJ*

Waldes Truarc Ring Replaces Nut and Washer ...Cuts Costs $5.28 Per M...Speeds Assembly by 50%



OLD WAY. Main shaft required costly threading. Assembly was slowed by the double application of washer and nut and time-consuming tightening operation.

TRUARC WAY. Truarc Retaining Ring snaps quickly and simply over shaft. Lock assembly is secured in one fast operation. Virtually all play is eliminated from lock.

NEW DESIGN USING WALDES TRUARC RING PERMITTED THESE SAVINGS

OLD WAY

Cost of Nut	$10.00	per thousand
Cost of Washer	3.80	" "
Labor for Threading	2.00	" "
Assembly	3.00	" "
TOTAL	$18.80	

TRUARC WAY

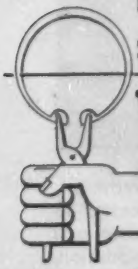
Cost of Truarc Ring and Grooving Operation	$11.52	per thousand
Assembly	2.00	" "
TOTAL	$13.52	

J. Chesler and Sons, Inc., Brooklyn, N.Y., manufacturers of the pre-assembled "Reddi-Mount" cylindrical lockset, uses a single Waldes Truarc Retaining Ring instead of an old fashioned nut and washer to secure the entire assembly of their lock. This new, improved fastening method enables Chesler to eliminate costly threading ... save money on material ... speed assembly time by 50% and produce an improved, more durable product.

You, too, can save money with Truarc Rings. Wherever you use machined shoulders, bolts, snap rings, cotter pins, there's a Waldes Truarc Retaining Ring designed to do a better, more economical job. Waldes Truarc Rings are precision-engineered ... quick and easy to assemble and disassemble.

Find out what Waldes Truarc Retaining Rings can do for you. Send your blueprints to Waldes Truarc engineers.

For precision internal grooving and undercutting ... Waldes Truarc Grooving Tool



SEND FOR NEW CATALOG

WALDES TRUARC

REG. U. S. PAT. OFF.

RETAINING RINGS

WALDES KOHINOOR, INC., LONG ISLAND CITY 1, NEW YORK

WALDES TRUARC RETAINING RINGS AND PLIERS ARE PROTECTED BY ONE OR MORE OF THE FOLLOWING U. S. PATENTS: 2,382,947; 2,382,948; 2,418,852; 2,420,341; 2,439,765; 2,441,845; 2,499,169; 2,420,941; 2,493,390; 2,493,393; 2,497,802; 2,497,803; 2,491,306; 2,509,081; AND OTHER PATENTS PENDING.

AM5976

Waldes Kohinoor, Inc., 47-16 Austel Pl., L. I. C. 1, N. Y.

Please send me the new Waldes Truarc Retaining Ring catalog.

(Please print)

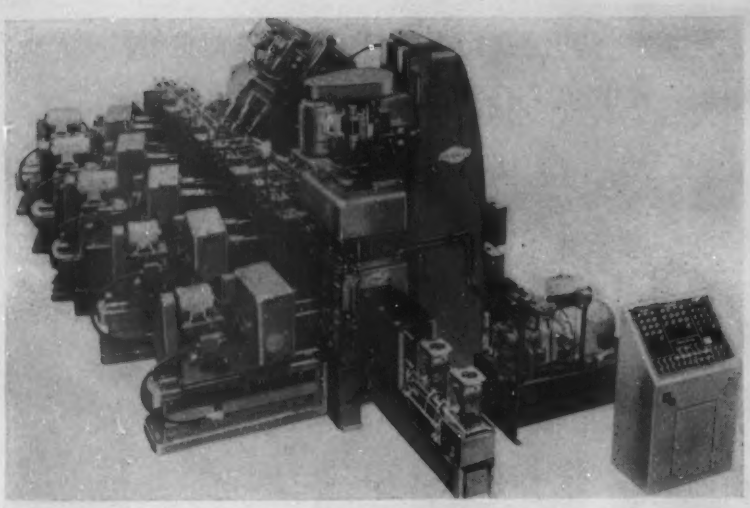
Name.....

Title.....

Company.....

Business Address.....

City..... Zone..... *State*.....



AUTOMOTIVE TRANSMISSION CASES are machined in this production line of four transfer machines. Machine combines facilities of 247 tools to complete 265 operatios in 29.5 seconds, averaging 122 cases per hour. The 17-station transfer machine illustrated is the second machine in the line. It performs drilling and reaming operations on bottom, top, and end of transmission cases. Safety equipment includes: steel mesh guards on and between each working station; all guards electrically interlocked; emergency cord for stopping machine from any position along its length; all functions hydraulically operated and electrically interlocked with malfunction indicated by a system of lights — *Greenlee Bros & Co, Rockford, Ill*

New Air Trip for Mead Impact Hammer

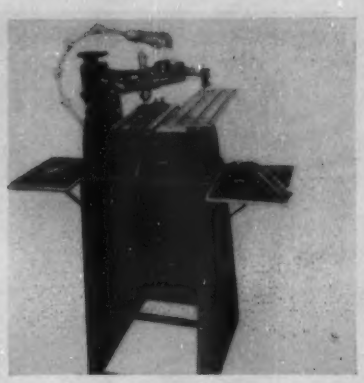
Mead air impact hammer incorporates more effective method of releasing hammer blow. Formerly spring tension on trigger mechanism was relied upon to release piston — now same result is accomplished by air pressure. Force of the blow is increased because greater resistance can be obtained by air pressure than by spring tension. Adjustment of force of hammer blow can be made while hammer is in action.

When compressed air is admitted to cylinder it expands and drives piston downward and it stops when it meets an obstruction such as the workpiece. At this point ram continues to exert pressure equal to air-line pressure multiplied by area of piston.

Another force at work besides the air pressure is momentum. Throughout the length of its stroke, the ram is subject to acceleration due to the expanding air behind the piston, and thus it reaches its greatest speed at the end of the stroke. The force of the blow can be regulated by varying the length of the stroke and this is done by moving the air cylinder up or down on its supporting column.

One more principle involved here is that by building up air pressure behind the piston and then releasing it suddenly, the greatest acceleration of the piston is accomplished. This is the purpose of the air trip in the present models.

Mead Specialties Co, Dept AT-4, 4114 No Knox Ave, Chicago 41, Ill



Preis Engraving Machine Now Has Floor Stand

Floor type of engraving machine has resulted from adding fabricated floor stand, handwheel screw worktable adjustment, and other features to Model UE-3 Preis-Panto engraving machine. Floor stand is of open front type with worktable adjustment. Handwheel immediately in front of operator; foot rest is provided and 10x12-in. shelf is placed at each side of engraver. Flexible aluminum lamp is incorporated as part of the equipment.

The height of the stand is 30 in. and the width is 19x19 in. deep. Assembly, including engraving machine is 47½ in. high by 23 in. left to right without shelves.

H P Preis Engraving Machine Co, 16 Industrial Branch, Hillside, NJ

TRUCK-AXLE CARRIERS are milled, drilled, and tapped on this Transfer-matic. With capacity for both spiral-bevel and hypoid carriers, machine processes 53 parts per hour with nine stations, one each for loading and unloading and seven for machining. A total of 97 operations are performed. Two-position, progressive workholding fixtures are transferred automatically from station to station. Features include: cleaning unit for removing chips; interchangeability of standard and special parts; construction to JIC standards; hardened and ground ways; hydraulic feed and rapid traverse; individual leadscrew feed for tapping a coolant system; and automatic lubrication—*The Cross Co, Detroit 7, Mich*

Learn how the

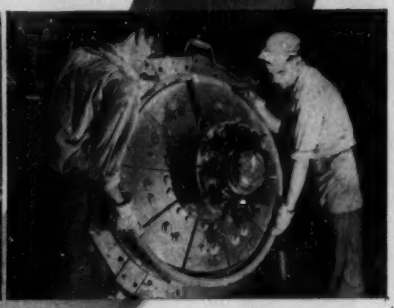
CLEVE-WELD PROCESS

cuts costs of circular steel parts

Ingenious and highly specialized processes now enable manufacturers to obtain certain types of parts at far lower cost than they themselves could make them by conventional methods. One of these is the Cleve-Weld Process for producing circular steel parts. Applicable to carbon, alloy and stainless steel rings over 6 inches in diameter and under 2½ inches thick, this process provides parts free from defects and so accurately shaped that rough-machining is usually eliminated. To describe the Cleve-Weld Process and its applications, we have prepared an illustrated 28-page brochure. We'll gladly mail a free copy to any production executive or machine designer. A handy request form is provided below.

FIRST STEP in Cleve-Weld Process: A straight steel bar is rolled into roughly circular shape.

SECOND STEP: Abutting ends are welded together by electric resistance flash butt welding.



THIRD STEP: Welded ring is stretched then compressed to prove the weld, assure exact diameter.

The CLEVE-WELD Process
for lower-cost circular steel parts

THE CLEVELAND WELDING COMPANY
West 117th Street & Berea Road, Cleveland 7, Ohio
A Subsidiary of
AMERICAN MACHINE & FOUNDRY COMPANY
NEW YORK

products are better...by design

The CLEVELAND WELDING CO., Cleveland 7, Ohio
Please send me your Cleve-Weld Process brochure.

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COMPARE... *LINE for LINE* and *FEATURE for FEATURE*

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SQUARE D COMPANY

Grip-Spintite Wrench Holds Nuts or Bolts

Machine taper lock grips nut or bolt as it is driven during assembly work to prevent loss or dropping. Tool is made in 12 sizes from 3/16 to 11/16 in. It uses no springs or magnets so the tool can be used on all types of materials. Wrench is not merely a starter, but actually a complete tool that clamps on the nut or bolt while tightening or loosening.

Stevens Walden, Inc, 460 Shrewsbury St, Worcester 4, Mass

Automatic Flux Valve

Valve gives positive control of flow of flux on automatic, submerged-arc welding applications. It is said to eliminate waste of flux and prevent possibility of operator neglecting to start flux flow. Using Herrick flux valve, operator knows when electrode is in direct contact with work.

Valve has been designed to operate with all Type LAF-2 automatic welding heads. When operator turns the "inch down" switch to weld position, flux automatically begins to flow after electrode contacts the work.

C B Herrick Mfg Corp, 2000 Center St, Cleveland, Ohio

Hand Tool Cuts ⅛-In. Drill Rod

Cam-action, high-leverage cutting pliers, 9 in. long cuts up to ⅛-in. hardened steel drill rod. Designated Pow'r Pli'rs, tool is said to handle jobs for which 24-in. bolt cutter or hack saw would be used. Jaws of the tool are forged, extra-hardened, and hand-honed. Handles are pressed steel. Retail price is $4.50.

Utica Drop Forge & Tool Corp, Utica 4, NY

Oven Chain Lubricator

Designed to fit directly to standard 5 gal. can of lubricant, unit consists of pump, ¼-hp motor, 2-ft applicator, 9-ft hose, and slow-speed mechanical agitator. Latter device produces homogeneous mixture of graphite and carrier. Unit is available with or without 4-castered dolly.

R G White Engineering Co, 1338 Atlantic Ave, Brooklyn 16, NY

For Easy Pipe Threading

2½" to 4"... it's the 4P

RIDGID

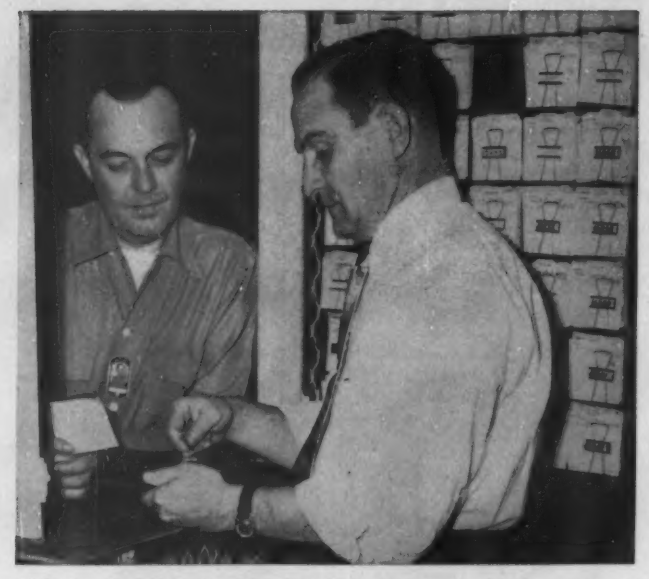
RIDGID 4P is easy to carry, easy to put on pipe

Balanced loop handles make it a cinch to carry and swing up on a pipe! Besides, the mistake-proof workholder sets to size before you lift it—only one screw to tighten on pipe. Easy upkeep—drive pinion in oilless bronze bearing; safe enclosed gear. 4 sets of 5 high-speed steel dies, 2½", 3", 3½", 4". Ratchet handle. RIDGID drive shaft available. Save work—buy 4P at your Supply House.

The Ridge Tool Company • Elyria, Ohio, U.S.A.

RIDGID

Work-Saver Pipe Tools



McCaskey Tool Crib Control, adapted to the unique production needs of U.S. Naval Ordnance Plant, Indianapolis, pays dividends in . . .

BETTER TOOL CRIB SERVICE with BIG SAVINGS in TOOLS and SUPPLIES

The Naval Ordnance Plant, Indianapolis, may be classified as a large jobbing shop developing, fabricating and assembling precision instruments. Approximately 20,000 standard tool items, together with consumable supplies and special tools, are required for normal production needs.

Six McCaskey-controlled floor cribs in addition to a large main tool stores crib provide prompt, economical tool service. They are operated under the supervision of Harold E. Evans, Head of the Tooling Division. He writes that their use of McCaskey Tool Control methods has given them:

. . . improved service at the crib windows;

. . . constant control of all tools;

. . . rapid, accurate clearance of terminating employees' tool charges;

. . . a 40% saving in procurement of standard tools and consumable supplies in first year's operation;

. . . monthly report of the cost of worn and damaged tools and miscellaneous consumable materials chargeable to each unit that is effective in holding them at a minimum;

. . . usage factor on all tool items that provides basis for reducing crib inventories;

. . . Broken or Lost Tool Report procedure that has reduced misplacement and loss of tools and makes available valuable data on reasons for breakage and for inventory and cost records.

Large or small, one crib or a dozen, similar results from improved tool crib control methods can be yours, too. Investigate NOW! Mail coupon for step-by-step procedure and detailed reports from representative users.

McCASKEY REGISTER DIVISION
Victor Adding Machine Company
ALLIANCE, OHIO

Send me all the facts on McCaskey Tool Crib Control.

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Company .....

Address .....

AM 7-5-54

McCaskey
INDUSTRIAL CONTROLS
PRODUCTION - INVENTORY
TOOLS - MAINTENANCE - COSTS
THE McCASKEY REGISTER DIV.,
Victor Adding Machine Co.
ALLIANCE, OHIO
Galt, Canada Watford, England

Paint-On Protection For Iron Surfaces

Sealube has developed ZRC, a paint which contains 93 to 95% metallic zinc. It may be painted or sprayed on and provides complete rust protection over wide areas, reportedly at low cost per square foot of coverage. Protection afforded is said to be fully comparable to that of hot-dip galvanizing, electroplating, or tumbling.

Some uses are: structural steel work; gas storage tanks, steel and iron pipes and ducts, water tanks, corrugated roofing, metal staircases, automobile and truck maintenance. ZRC can be applied directly over rusted surfaces and will check further rust spread and reduce amount of rusting present in time of application. Protection provided is based on electrochemical action. Metallic zinc, when exposed to corrosive atmosphere becomes anodic—entire steel area covered becomes cathodic. Corrosion attacks at the anode or zinc layer, leaving the steel untouched.

Brushing is preferred method of application, but ZRC may be sprayed. It can be used as a metal primer coat. It dries to flat gray finish, touch dry in 30 minutes, and completely hard in 4 hours.

Sealube Co, Wakefield, Mass

Lubricating Stick

Hyperstik is 2¼ in. in diameter and 8 in. long—is reported applicable to grinding, tapping, threading, drilling, pipe cutting, metal spinning, sawing, and sanding. Ingredients include a fine cutting oil, lubricant elements of a confidential nature, combined with compatible enveloping material. It is said to perform with equal efficiency on ferrous and non-ferrous metals, including all grades, hardnesses, and alloys.

Destiny Products Co, 2970 West Grand Blvd, Detroit, Mich

L-M washers edgewound from flat wire are now available in the No Tangle-Notch Coil form. Washers, produced without dies from standard wire-stocks, eliminate blanking scrap losses and are said to reduce silver brazing costs as much as 60%. When used, each is snapped from the coil and preplaced on work as needed. Suitable for use with induction, gas-air, furnace, or any conventional heating method. Diameters up to 4 in. ID are held to close tolerances in thicknesses from 0.010 upward. Available in easy flow and Silfos, as ell as copper, bronze, etc.

Lucas-Milhaupt Engineering Co, Cudahy, Wis

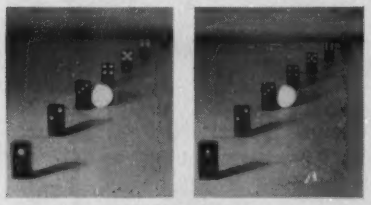
Plain Pointers on Projection

ONE of the claims we make concerning the Kodak Contour Projector is that once an object is brought into focus at any given magnification it will remain in focus when magnification is changed. (This freedom to change magnification is made possible through the use of a lens turret, mounting six lenses, and speeds inspection procedures.) An operator only need flick a dial to switch from one magnification to another; no time is lost refocusing.

Occasionally, however, one of our customers writes to question our claim and declares that he has found it necessary to refocus when changing magnification. This does not upset us. Almost invariably the difficulty can be traced to the phenomenon of optics called "depth of field." This refers to the distance between the nearest and farthest points sharply defined by a lens and is aptly illustrated by the picture below. It is apparent that when a lens is focused on one object, other objects—nearer and farther from the lens—may appear in acceptable focus.

One of the characteristics of this phenomenon of depth of field is that it decreases sharply as magnification is increased. This is equally true when a lens is focused on an actual object, as with a camera, or on an image of that object, as is the case with our contour projector. The result is that when working at higher magnifications depth of field is considerably less than when working at lower powers.

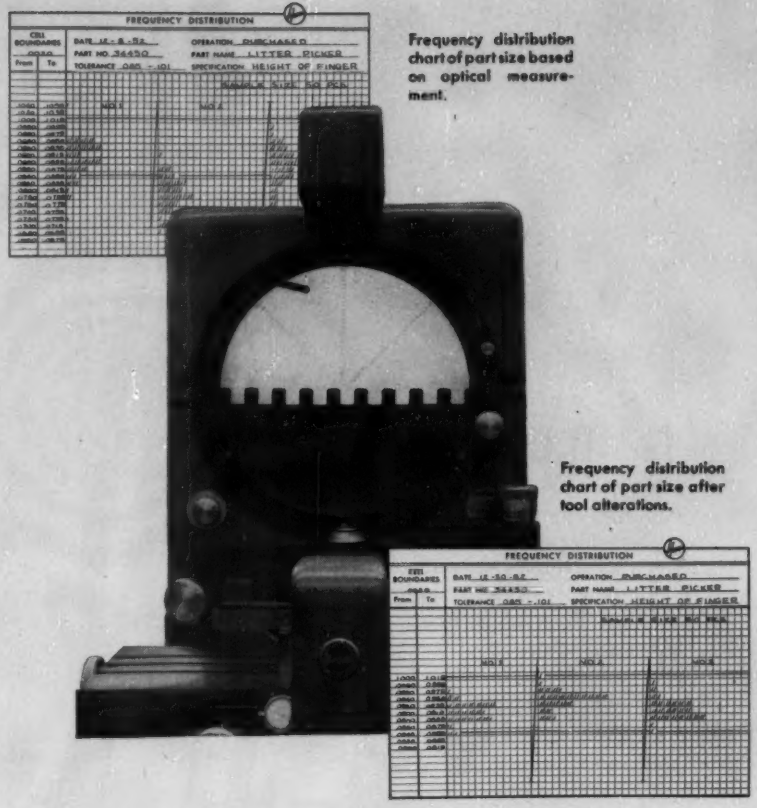
Consequently, it is possible that an object in focus at 10 power may appear out of focus when magnification is changed to 100 power, where depth of field is less and the need for precise focusing correspondingly



greater. Because of this, we recommend that, when inspecting parts at several magnifications, the part first be focused at the highest magnification to be used. This insures focusing within the narrowest tolerances and, when magnification is changed to a lower power, the part remains in sharp focus on the screen. When this recommendation is followed, complaints on the need for refocusing vanish.

Incidentally, it should be mentioned that neither focus nor depth of field affects accuracy of magnification with the Kodak Contour Projector. This remains as rated irrespective of the precision of focus, thanks to what our optical people call a telecentric stop. Which, in itself, is subject for another in this series of columns.

(Advertisement)



Frequency distribution chart of part size based on optical measurement.

Frequency distribution chart of part size after tool alterations.

Saved...296 pieces per thousand!

Like many another manufacturer, the Hoover Company, Canton, Ohio, has its rejection problems. A typical one involved a flexible, rubber-like "litter picker" used in its vacuum cleaners. Although tolerances ranged from .085" to .101", rejects ran as high as 30%.

To solve this problem, Hoover employed a Kodak Contour Projector to measure the parts, plotted results in accordance with modern methods of statistical quality control. Based on these studies, alterations were made in the cutting tool and the holding fixture for the part. Rejects dropped from 30% to less than ¼ of 1%. Savings amounted to 296 pieces per thousand.

"Optical gaging with the Kodak Contour Projector," say Hoover engineers, *"eliminated incorrect readings caused by mechanical distortion of the parts. In addition, optical methods of measurement proved from 4 to 5 times faster than conventional gaging techniques."*

Your own production measurement or inspection problem may similarly be solved by optical gaging with a Kodak Contour Projector. To find out more about it, send the coupon for your copy of "The Kodak Contour Projector."

EASTMAN KODAK COMPANY 90

Special Products Sales Division, Rochester 4, N. Y.

Please send me a copy of your booklet, "The Kodak Contour Projector."

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ (Zone) STATE_____

Kodak

ACCEPTED!

Carb-O-Plating

has won favor throughout industry as one of the most efficient methods of imparting extra wear to the surfaces of gages, parts and tools.

This method employing the Linde Process applies a thin wear-resistant coating of tungsten carbide in wearing surfaces to extend the life of gages and hundreds of tools many times over.

Carb-O-Plating gives you wear life of carbide at a cost substantially lower than the use of solid material can give you. And because of the steel base, the products have resistance to mechanical shock and are not subject to breakage as can occur with sintered carbide. Carb-O-Plating also increases accuracy.

If you don't know about Carb-O-Plating, you're missing many advantages. Let us explain.

THE PLUS IN PRECISION

Lincoln Park INDUSTRIES, INC.

1719 FERRIS AVENUE, LINCOLN PARK 25, MICH.

DESIGNERS AND MANUFACTURERS OF: SPECIAL AND STANDARD CARBIDE CHROME PLATED AND STEEL GAGES CARBIDE ROTARY FILES • ALSO FACILITIES AND SKILLED PERSONNEL AVAILABLE FOR PRECISION PARTS PRODUCTION.

Machine Drills and Reams Opposed Holes in Line

Govro-Nelson has announced a machine designed to drill and ream opposed holes in line at a high production rate. It incorporates a 6-station Geneva-type indexing dial electrically interlocked with 4 Govro-Nelson KH automatic drilling units. The part that is being drilled and reamed, upon being manually loaded and clamped, is automatically drilled, reamed, unclamped and ejected.

Govro-Nelson reports that in one plant where the machine is being used it drills and reams two opposed holes in an automotive part and achieves a production rate of 900 parts per hour.

Govro-Nelson Co, 1933 Antoinette, Detroit 8, Mich

Hardfacing Electrodes

Series of general service iron-base dc hardfacing electrodes having new metallic coating reportedly provides improved weldability and arc stability. Electrodes are made of chromium, boron, and iron composition and are available in two types —Colmonoy No. 1 where extreme impact with high abrasion resistance is required and Special No. 1 where extreme abrasion and impact resistance are required.

Electrodes are reported to provide dense deposits that do not require cleaning or slag removal by chipping or brushing before welding on successive deposits. Electrodes can be used in special applications where the deposit must be welded on vertical surfaces.

Wall Colmonoy Corp, 19345 John R St, Detroit 3, Mich

Automatic Welding Machine For Long Pipeline

Portable automatic welding machine was used during laying of longest aluminum pipeline ever installed. It welded 40-ft sections of 8 and ⅝-in. aluminum pipe in average time of 4 min for five-pass weld. Suspended over the line by a side boom, the welder is equipped with quick-acting clamps which securely grip pipe. Pressing a button starts welding and automatic controls maintain proper conditions of arc. When weld is complete, the machine automatically stops, reverses itself, and returns to starting position. Clamps are then released and machine moves to next weld.

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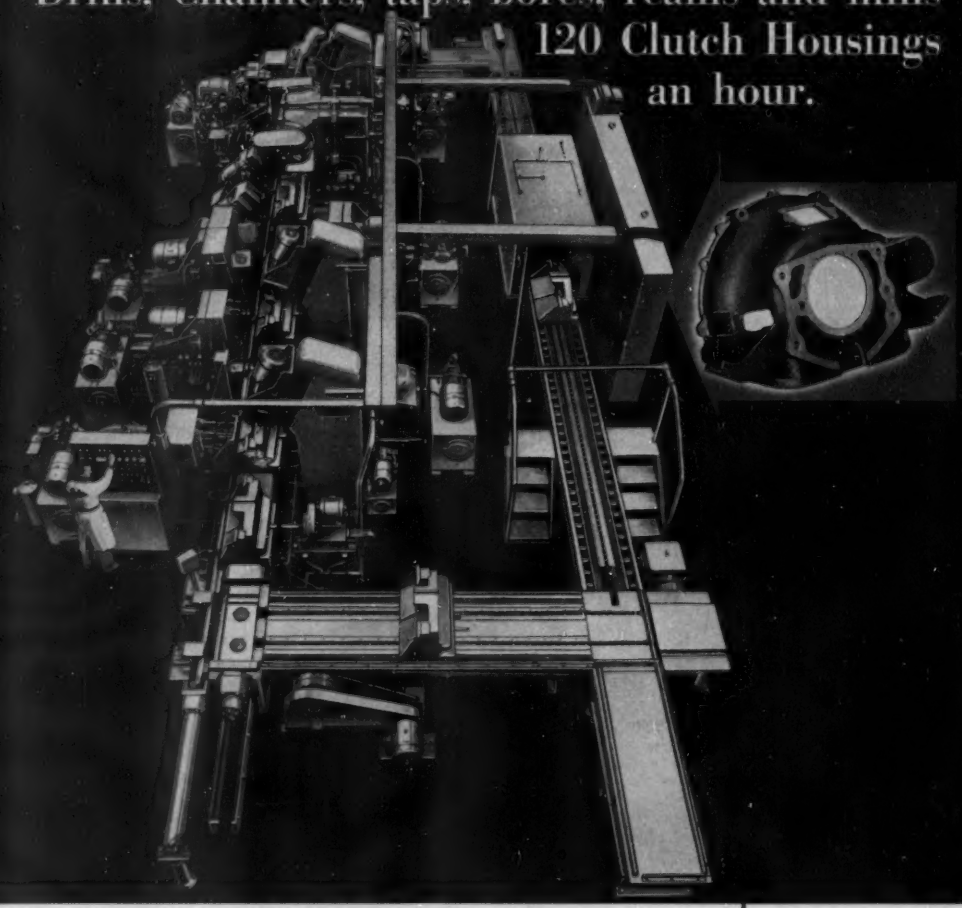

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Production is 120 parts per hour at 100% efficiency.

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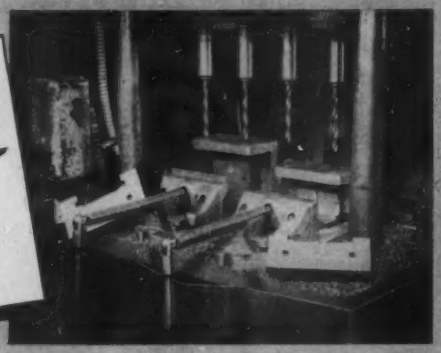

Here's a production set-up on a multiple spindle semi-automatic drilling machine that is really cutting manufacturing time and costs. The use of two Speed Vises eliminates the need for expensive and complicated fixtures and at the same time increases the production range. With Speed Vise it is only necessary to make a simple jaw plate to fit the parts being machined and to hold drill bushings, etc.

★ Quick action design for speed. Opens instantly to full capacity to handle work of any size.

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★ Lift... slide... lock... that's all there is to the fast, positive locking action.

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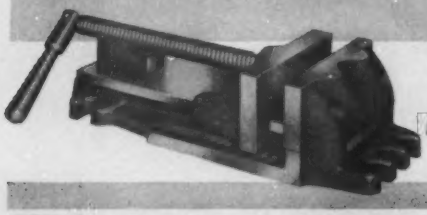

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ROUND TABLE *Discussion*

CO-OP LOOT

Does profit sharing tend to increase the individual worker's interest in production output? If so, what sort of plan works best? Will the men accept the fact that every year is not a profit year?

PROFIT-SHARING SOUNDS very fine and altruistic, but behind it there are a lot of headaches. In the first place, the company was formed for the purpose of making a profit for the stockholders, the people who risked their savings in the hope that the venture would be so well managed that it would continually pay a better return on the investment than if the money had been invested in some other business. It is thus the duty of the management to endeavor to accomplish this, and if the management does not succeed, the members are apt to be fired just the same as an incompetent workman is. It is thus obvious that any profit-sharing plan must result in a proportionally higher gain, so that the profit-sharing will not result in a reduction in dividends. If it does, the stockholders will show their displeasure by voting in a new board of directors.

Ed's statement "Profits to the stockholders; wages to the men," is on solid ground. The stockholders expect a fluctuation in earnings, which is reflected by a variation in the dividend rate; but while the workman is quite happy with an increase in pay due to profit-sharing, he is

"But I was merely commenting on the weather when I said 'it's too nice a day to be working.'!"

very apt to violently resent all decreases in pay due to changing business conditions, or a recession, and resentful workmen are certainly no help towards getting the plant out of a business slump.

From my point of view he is not likely to do so. If this manager would listen to me I would tell him to inform the big boss that the best way of avoiding paper work is to limit the working program to the smallest number of types or models possible. The make-all attitude is the worst efficiency-killing principle practiced since Frederick W Taylor's days. I doubt if young, and sometimes more experienced managers, understand how many times orders multiply in the shop when a new type is added to those already in production. I have seen many shops ruined because they have made up working programs, so varied or mixed, that their foremen have been tied down all day long at their desks writing, instead of trying to develop more efficient tools and methods; it has even been impossible sometimes to use special tools and advanced methods because this has proved too costly.

In such cases it is the managers, or the big boss, who should be blamed, since their policy has made it impossible to work efficiently, but foremen often get the blame because they are unable to hold together the multitude of orders, drawings, tools, prices, and a lot more. A really efficient run of things can only be achieved where a specialized product is turned out, but how many managers are fully aware of that fact? I'm afraid there are quite a few industrial leaders who have no opinion at all about this important principle.

In a specialized production it is possible perhaps to make 500 or more equal details at a time, while in mixed production very likely a small number of many different pieces is the rule. This affects the paper work tremendously. In the former case, it is easy to write materials requisitions and a few operation blanks, while in the latter ten or more duplicates are necessary.

If the writing of memos at the foreman's desks speeds up the work at the lathes, milling machines, or benches, it would be an easy matter to accomplish, but this I doubt. Why is it necessary at some big places to hire efficiency men whose duty it is to look after the jobs, if the same thing could be achieved at the desk? No, this is dreams only.

Al's argument about more organization reminds me of a story I read in this magazine many years ago and which might be worth recalling. In

BE *Sure* YOUR
NEW ENGINE LATHE
CAN *Take* IT!

The engine lathe you buy today could be the one you will call upon for 'round-the-clock production. Make sure, before you buy, that the lathe of your choice can take such punishment.

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What is the headstock gear arrangement?
MAKE SURE OF THREE POINTS

(1) That all gears are arranged in a horizontal plane; easy of access.
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On these three points long life for engine lathes depends. At these three points Boye & Emmes Long Life, Heavy Duty Engine Lathes excel.

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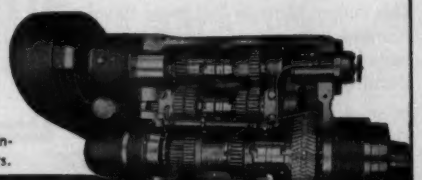
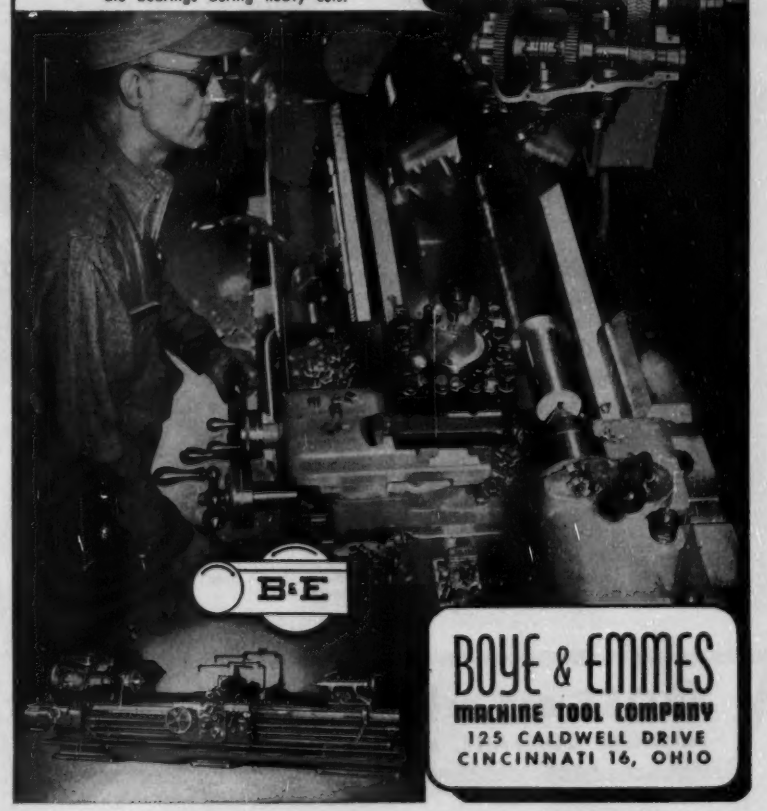


"Back-gear-in-front" guards spindle bearings during heavy cuts.



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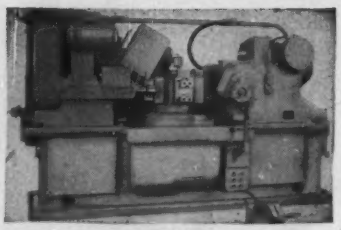
GOSS *and* DeLEEUW
Automatic Chucking Machine
in 1 SET-UP

This recent Goss & DeLeeuw development has already received universal acclaim as an outstanding development.

In speed, ease of tooling and precision finishing, the "1-2-3" chucker provides engineering advantages which result in vastly greater production at a fraction of parts' costs by other methods.

Easy, fast change-over from job to job makes this machine ideal for short-run requirements. Sturdy construction, power and speed make its advantages apparent on long runs.

"1-2-3" means ability to handle work requiring machining operations on one, two or three ends simultaneously or in sequence — a method exclusive with Goss & DeLeeuw and offered on this machine.



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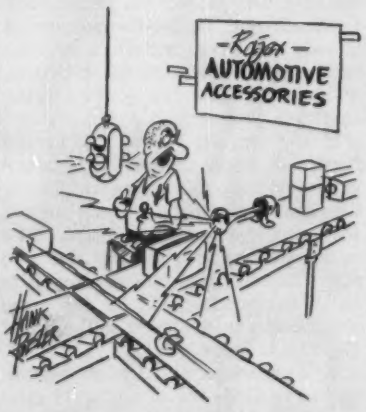
the main it read as follows: An elderly man had been running a machine shop several decades and lived on the business comfortably. As he was growing old, he wanted to quit, so he sold his shop to a young man. This young man thought the organization of the shop was out of date, so he decided to reorganize the whole works. But after this was done he made no money. Then the young man went back to his predecessor and asked him how he could make a profit. "Oh, that's easy to explain," replied the old man. "When I made a dollar I kept it, but when you make a dollar you use it to find out how you made it."

A E Fristedt
Stockholm-Bromma, Sweden

I HAVE ALWAYS BEEN an advocate of profit-sharing plans. It seems to be the only way in which the employer and employees can get full value out of maximum production. I cannot blame Ed for getting hot under the collar about the plan of rating each department and distributing the rewards in each according to the amount each contributes to the plant as a whole. This scheme engenders cut-throat competition, wherein the purpose of sharing is cooperation in every respect.

The time has long since passed when an employer thinks he can make his business run at its highest efficiency without the 100% cooperation of his employees. You cannot get this by paying them so much an hour—you have to give the men something to work toward. You have got to give them something that calls upon the resources of every employee.

Life of the worker becomes monotonous unless there is something besides his wage to lure him on to



"Hold your horses!—The light just changed!"

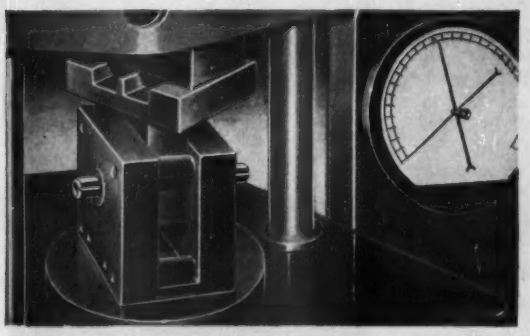
Normal leverage puts the load on the pins at these points. Pins must have a high resistance to shearing — and every pin must stand up to plenty of abuse. Many manufacturers' tests have proved Rollpin's uniformly high shear strength.

consistent strength... as important in the pin as in the socket

The Moore Drop Forging Company, who manufactures the famous Craftsman wrenches for Sears Roebuck and Co., used stainless steel rivets to fasten the universal joint on their Flex sockets. Thorough testing, under all possible load conditions and drive angles, convinced them that Rollpin was stronger than the stainless steel rivet previously used. This led to a redesign of the joint with Rollpins replacing the rivets. Also, the spring tension inherent in the Rollpin locking principle was used to provide the "drag" that holds the socket head in angular position. The result . . . an improved product at lower cost.

Dependability like this is based on the rigid ESNA® quality controls that insure consistent strength and mean reliable performance by every Rollpin.

Moore Drop Forging Company was able to save assembly time, too. Rollpin is simply driven into holes drilled to normal production tolerances. It compresses as driven, locking itself in place by exerting pressure on the hole walls. In this case, the extra operation of spinning on a rivet head was eliminated.



We urge you to test spring pins before you buy — for uniformity of diameter and length, hardness, insertion and removal forces, and recovery of diameter, as well as shear strength.

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Dept. R29-79, Elastic Stop Nut Corporation of America
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Please send me the following free fastening information:

☐ Rollpin samples
☐ Rollpin bulletin
☐ Here is a drawing of our product. What self-locking fastener would you suggest?

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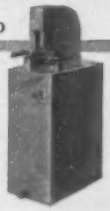

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his greatest effort. There are some who might take offense at the term "lure" and think I am comparing the worker to a fish—a sucker for instance. Any scheme to increase sound production is a form of bait, no matter how one looks at it. Any scheme advanced is nothing more than an effort to get the lead out. Some kind of an idea that will do this, and at the same time get the worker to think in terms of the whole shop, will certainly result in closer cooperation between the workers and management.

We know that hourly wages alone produce in a great many a tendency to shirk. Killing time seems to be a national pastime for some, while others will strive to do their very best in the hope that rewarding recognition will eventually come their way. Discontent is easily spread among hourly-paid employees with the result of the inevitable interference with production. Loss of time caused by strikes results in the worker going into the hole deeper, thereby causing greater dissatisfaction.

The smugness of some employers who harbor the thought that they are capable of running the business without the aid of the workers does nothing to alleviate the dangers of opposition between the employee and his employer. Let him rest not upon his laurels of accomplishment by thinking that he alone causes his business to go forward—if he is content with running along on one cylinder, it's his loss. He must have the complete cooperation of all his workers if he is going to extract the paying juice from his invested dollar.

It is not a consoling thought, for a man who works day in and day out just to know that he works for so much an hour without any further reward for him to look forward to.

1 OPERATION INSTEAD OF 3

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Woodruff & Stokes specialize in small tool design and manufacture. For example, supplying small cutting tools requiring diameter tolerance of ± .0002" or closer and as many as five cutting diameters is not unusual. Woodruff & Stokes have made these tools their business.

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Life to him becomes monotonous; it lacks a goal other than the regular pay check.

In past years we have seen an effort to gain the cooperation of the worker by such things as piecework, bonuses, and an annual blowout as a reward. The piecework has its merits in that it gives the worker a shot in the arm, so to speak, whereby he will put forth his best effort to produce. Where a scheme is designed to increase the worker's effort based upon his selfish interest, you can depend upon it that he is going to get all he can, regardless of the consequences. Usually these are detrimental to the upkeep of the machinery and tools.

There must be something else besides a worker's selfish interest in his own gain that is necessary for complete cooperation. To increase the output of a worker by tempting him with a reward for the amount of work he turns out will no doubt assist in picking up production, but such practice has produced a one-sided result not beneficial to the whole group. In my opinion, a piecework doesn't give a damn for anything but his own gain. He'll wreck machinery; he'll crowd tools unnecessarily; and worst of all, he'll develop a selfish attitude that will not result in real cooperation so necessary for complete productive harmony.

Rex Warren
Waterloo, Iowa

THE USE OF A profit-sharing plan as a means of improving production looks good on paper, but the cold facts of experience have tended to discredit the effectiveness of such a plan as an incentive device.

Profit sharing is one of the most controversial methods of compensating employees, with some advantages but more serious drawbacks. It has been used in various forms and by many employers for more than a century, with results ranging from brilliant success in some instances to dismal failure in others.

The general conception of profit sharing is that it consists of payment of some portion of the profits of the company to different interested parties as compensation over and above that contracted for. Proponents point out that as a system it has the advantage of providing a definite floor in the form of wages, salaries, and regular dividends upon which the recipients can count, with potential payments in addition if the concern earns unexpectedly large profits. It thus provides an in-

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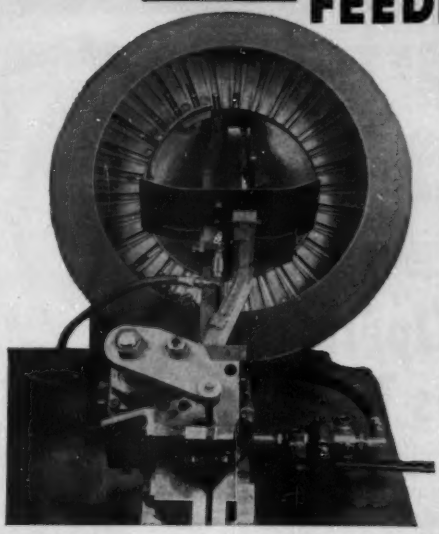

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● Here is an interesting case showing separate screws and lock washers that were loaded into a single feeder and ejected loosely assembled at the rate of 60 to 70 a minute . . . An amazing speed increase over slow, manual operation. In this instance, as in thousands of other applications, the unit was designed with the idea of maximum feeding of a wide variety of parts at a fraction of the cost of manual feeding.

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Our Newest Addition

● An electric, vibrating unit that advances the parts on a circular spiral, aligning and correctly locating them to issue directly into the work area in proper time cycle. Provides fully automatic feeding of light, fragile parts that normally could not withstand tumbling.

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Wilson "Rockwell"* Hardness Testers

SET-O-MATIC* DIAL GAUGE

Eliminates human error. Operator merely applies minor load and taps depressor bar. No setting of dial to zero.

OTHER FEATURES

- Major load applied under dash pot control
- Major load removed by motor
- Illuminated Dial Gauge
- Illuminated Penetrator

Eliminates Operations... Increases Tests per Hour

All you have to do with the Model Y WILSON "ROCKWELL" Motorized Hardness Tester is apply the minor load and tap the major load depressor bar. The machine does everything else automatically. The cycle of Major Load operation may be less than 2 seconds.

This speed of test means great savings in time which will reduce your hardness testing costs. Yet it is done to Wilson's high standard of accuracy.

The utter simplicity of setting the SET-O-MATIC* dial gauge eliminates human error. The operator does not have to set the dial. The large pointer is automatically brought to "SET" position when the minor load is applied.

The Model Y Motorized WILSON "ROCKWELL" Hardness Tester is in production and orders are being accepted for early delivery. Write today for descriptive literature and prices.

*Trade Marks

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Wilson Mechanical Instrument Division
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centive to labor to increase those profits as much as possible.

On the other side of the coin is the tendency of recipients to consider disbursements as a continuing addition to their incomes and to resent curtailment or discontinuance. Even with conscientious administration of a profit-sharing program, a lower level of general business activity, unwise managerial decisions, or some other conditions may eliminate profits and profit sharing, just as they can impair the integrity of a guarantee of work.

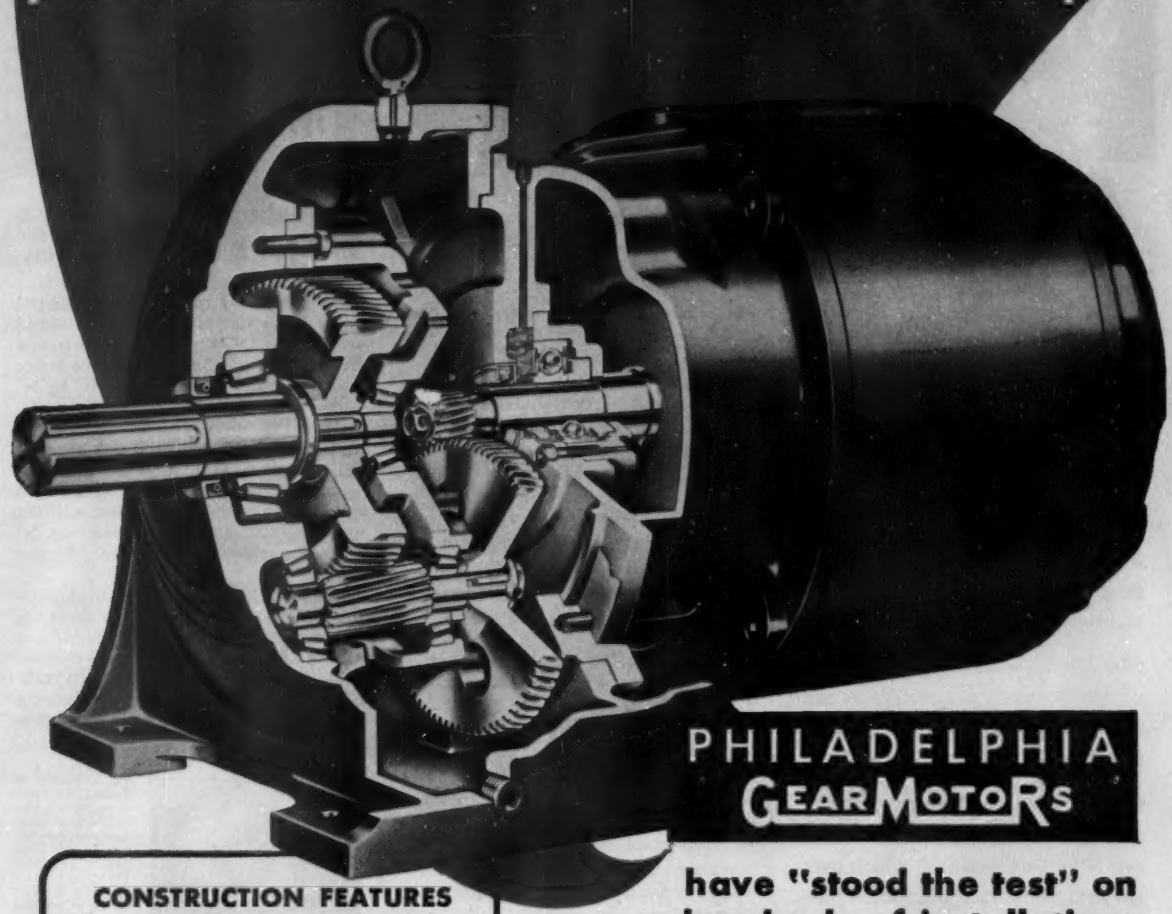
In my opinion, a serious objection to profit sharing, where each man in the department gets the same share, is the difficulty in the employee's mind of relating the reward to individual effort, and the fact that the energetic and the lazy are rewarded in equal measure. However, as Ed points out in the case under discussion, there may be some value in a profit-sharing plan if it can be made to work out. But a workable plan seems to be the exception rather than the rule.

A plan of payments predicated on the company's profits may tend to improve employee morale—at first. Unfortunately, there is an equally strong tendency for the good effect to wear off and for the annual payment to be considered as part of the regular compensation. If it should then become necessary to discontinue the payment because of lack of profits, there is almost certain to be a great deal of resentment among the employees over what they regard as a reduction in their regular and legitimate income.

If the average worker were asked for the most important incentive for working for a given concern, it would undoubtedly be found that monetary compensation, which is always important, is by no means the most important. The desire for steady employment over a long peri-

"Alright, you guys, stop playing with the inspector's telescope!"

performance IS THE BEST TEST OF leadership



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have "stood the test" on hundreds of installations

In almost all branches of industry Philadelphia GearMotoRs are giving the trouble-free service that is proof of their excellent design and precision manufacture.

Where the direct application of electric drive to individual machines is desired the Philadelphia GearMotoR will conserve space and simplify the installation as well as offer definite operating advantages.

They are available in single, double and triple reductions with a speed range from 780 through 7.5 R.P.M. Motor ratings run from 1 HP through 75 HP AC or DC.

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od of time will be well up toward the head of the list of incentives.

Profit-sharing arrangements, have a long history. Yet they have never become common. They attract widespread interest whenever industry is prosperous. Studies have indicated that only a very small proportion of firms tried them and that the mortality has been high. No simple pattern characterizes these plans. They vary widely in coverage (many are limited to executives and top-level administrators) and in methods of sharing. In general, they provide for a system of dividing net profits, usually establishing an amount which is set aside for dividends, and specifying how any excess shall be divided.

The idea of profit sharing appeals to some employers. In some cases they set aside employee shares of profits in so-called deferred-distribution plans, to provide retirement security. These employers regard profit sharing as an opportunity to take employees into partnership, as "silent" partners. They feel that, as partners, employees will have an added incentive to work hard and eliminate waste. They reason that their employees help make possible a profit on the business operations, are entitled to a share in the earnings available for distribution. In contrast to this philosophy is the point of view of the orthodox economist who believes that all profits belong to owners who risk their capital in business undertakings. It is frequently pointed out that employees do not share the financial losses of a business but usually enjoy a fixed wage, whatever may be the financial results of the company's operations. Consequently, from this standpoint, they would not seem to be entitled to a share in a company's profits. This is the reasoning to which I subscribe.

Many distribution plans have been tried. The commonest method of apportioning the profit-sharing fund among employees is according to each employee's wages. The theory here is that the difference in skill, length of service, and value to the company is accounted for by the difference in wages. In rare cases the profit fund is totaled, divided by the total number of employees, and each employee is paid the same amount.

Some companies heavily weight rank or importance of position in determining an employee's share in distributed profits. Obviously, this feature favors management and supervisory groups which may be desirable in view of the ability of the management group to motivate all workers. These methods of distribu-

WITH FOUR TIMES THE SPEED; ONE FOURTH THE DISTORTION

"Manual Lincolnweld's" high-current-density welding could solve your fabricating problem

THE PROBLEM: To fabricate a table 46″ square calls for welding 1″ plate, ribbed with 2″ by ½″ and 4″ by ½″ bar and channels from 3/16″ plate. The hub is hot rolled bar and center ring is 6″ by ¾″ stock. With hand welding, distortion averaged ½″ to ⅝″.

LINCOLN'S ANSWER: High-current-density welding in agglomerated flux with "Manual Lincolnweld" at speeds 4 times that possible with hand welding using coated electrodes. Speed on ¼″ fillets increased from 7″ to 28″ per minute.

THE RESULTS: Concentrating high welding currents on 5/64″ electrode gives full penetration in one pass. Distortion is reduced from ⅜″ to only ⅛″. Welds are smooth, uniform and essentially self-cleaning, saving manhours in cleaning and finishing to cut shop production costs still further.

Fig. 1. Simpler to Fabricate. Positioner table is fillet welded with "Manual Lincolnweld's" hidden-arc welding in granular flux. Welding speed for ¼″ fillet weld is 28″ per minute. Photo courtesy Worthington Corporation, Plainfield, N. J.

Fig. 2. Rugged Welded-Steel Table is fabricated for less cost. Welds are smooth, uniform, ductile. Distortion is cut 75% over hand welding.

WHAT'S YOUR PROBLEM? Complete Automatic Service — machines, electrodes, engineering—is available at one source . . . Lincoln. Your nearest Lincoln representative can demonstrate the latest developments in hidden-arc welding to speed your production and cut shop costs.

Bulletins on boosting production efficiency with "Manual Lincolnweld" are available by writing on your letterhead. Ask for Bulletin 1303. *Dept. 2005.*

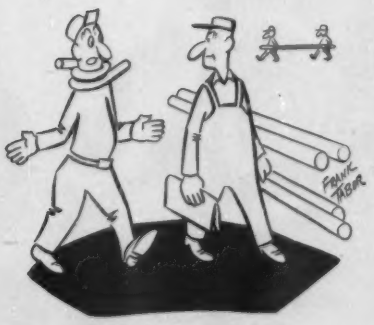
THE LINCOLN ELECTRIC COMPANY
CLEVELAND 17, OHIO
THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

tion are certainly fairer and more effective than the arbitrary distribution on departmental basis where each department is considered as a unit and each man in the department gets the same bonus, without regard for the varying efficiency of the different works of the departmental group.

It seems to me that a better incentive plan than profit sharing, and one that is certain of working out successfully, is a bonus award to supplement wage payments. The bonus is only paid to the individual entitled to it. Bonus awards may be for attainment in any one of many directions, such as quantity of output, quality, inventiveness, decreased costs, saving of materials, or for teaching new workers. The payment of the bonus is generally made in a lump sum either every six months or once a year. It is common to wait until the end of the year, when results of operations can be determined accurately. Indifferent workers and slackers find an uncongenial environment and are weeded out, for if the plan is a success, employee cooperation is secured, non-cooperation minimized, and individual initiative encouraged. Intelligent workers will experience no difficulty in understanding a bonus plan that rewards individual initiative and efficiency, and individual merit. An employee who is profit-minded for his employer will find that it pays off for himself as well.

Harry Kaufman
Philadelphia, Pa.

As businesses go these days we would be regarded as being on the small side. In spite of our size we have been conducting a serious investigation and study of incentive plans in the hope that we can introduce a practical, successful one. The size of a company is a relative dimen-



". . . naturally, when he said he'd wrap that one and fifteen-sixteenths shaft around my neck, I laughed . . ."

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ABRASIVE BELTS

For grinding, smoothing, polishing — metal, wood, leather, plastics, rubber. A grit for every purpose — prompt service on every purchase.

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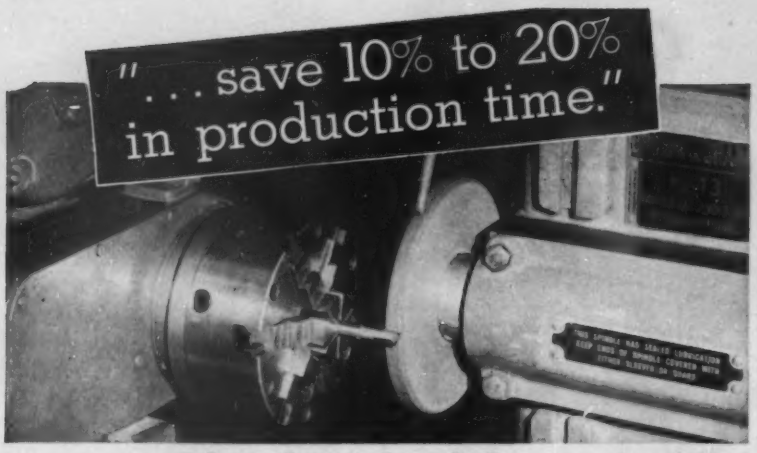

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Only universal scroll chuck with .0005" precision—for lathes, grinders, dividing heads, screw machines.

3-jaw and 6-jaw in 4", 5", 6", 7½", 9" sizes. 2-jaw Aviation chucks, for odd-shaped parts, in 6", 7½", 9" sizes.

ALSO SUPER-GRIP 4-JAW INDEPENDENT CHUCKS FOR 9" to 16" LATHES.

Grinding the diameter and face of a centerless carbide tipped end mill — within plus .0000", minus .0005" — on a 5" Buck chuck is shown at the Brubaker Tool Corp., Millersburg, Pa.

THEIR REPORT: *"The chucking of various diameters to close tolerance is expedited with the Buck Ajust-Tru chuck. By limiting the indicator truing and chucking necessary with the old line chucks, we save 10% to 20% in production time."*

You save *every* time you use a Buck — for dead true work, on duplicate parts chucking at scroll chuck speed (.0005" precision guaranteed), by eliminating costs of collets and special holding fixtures. No price premium. Send for latest catalog today.

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Illustrated is a Cincinnati Gilbert 4'-11" column Radial Drill equipped with a Gusher Coolant Pump.

Ruthman Gusher Coolant Pumps are better three ways

1. Gusher Coolant Pumps give you split-second coolant flow when the machine is turned on.
2. Pre-lubricated heavy-duty ball-bearings, totally enclosed drip proof motor, elimination of packing and priming, cut maintenance to a minimum.
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Always Specify Gusher Coolant Pumps

THE RUTHMAN MACHINERY CO.

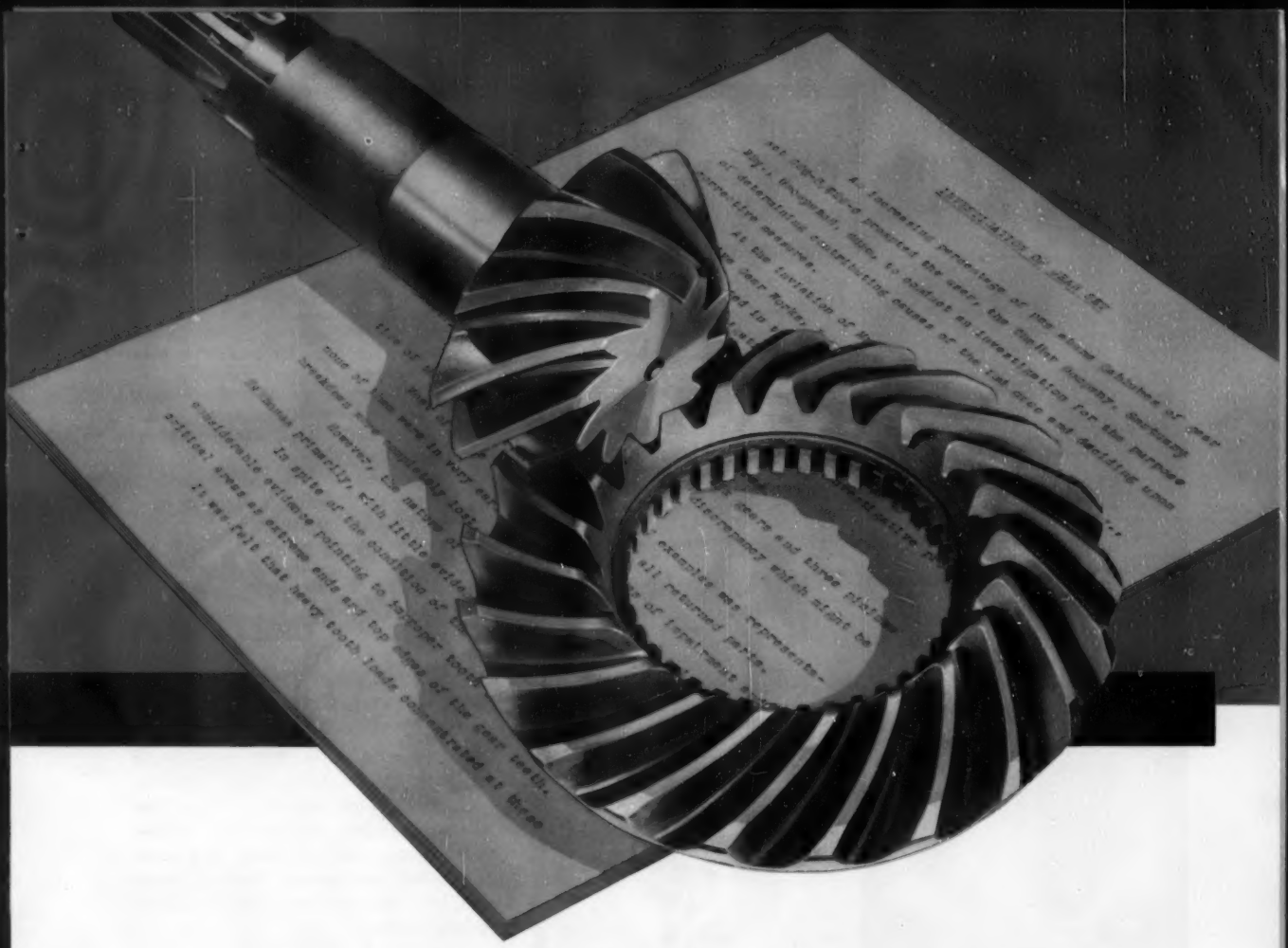
1818 Reading Road, Cincinnati, Ohio

sion, and big or small, the company a man works for is the company which is most important to him.

As we look about us we can everywhere see possessions, and indications of wealth. We see homes, cars, furniture, and a literally endless array of articles produced by man's labor. Everything we own or see, except the land on which we live, was produced by human exertion, expended on the raw materials taken from the land. In short, what man has is what man has produced. To have more, we must produce more. Unfortunately for the individual worker, the corollary is not always true, that is, if a worker produces more, he will not necessarily receive more. More production and an honest share of it for everyone responsible is the surest road to continued prosperity and an advancing standard of living. Better work, or more of it, is the only way a person can earn more money without raising costs and thereby harming himself in the long run. More pay for less production is pure folly.

The problem resolves itself into one of increasing production by giving the worker a share in what he produces. There are a variety of incentive plans available. The important decision is to select a plan which is suited to the type of work and to the organization. The plan must of necessity be simple and direct, and easy to apply. It must be simple so that the operation of the plan does not become costly and self-consuming of the hoped-for gains. It must be of such a nature that the individual worker can calculate, or at least estimate, his incentive earnings; he should know how he is doing as he goes through his work, otherwise he may be disappointed and dissatisfied. It is advisable to distribute the incentive money, or bonus, promptly,

"Could I have a minute to find out all you know about this job?"



BETTER GEARS

via Pullman and Paper Work

A lot of time, travel, study, and testing can go into the improvement of gears.

The report and gear set shown above is a case in point. The 4,000-word report was prepared from facts gathered at the customer's plant. It details performance factors right down to the ground—pin-points every specification that will produce better gears to do a better job.

From this study trial sets were made, tested exhaustively *at* the customer's plant *in* his product.

Then the order was received.

Not all gear problems are as tough as this. But when you're faced with *any* gear problem, write us the facts, telling us where you are and when we can see you.

DOUBLE DIAMOND TRADE MARK GEARS

FOR AUTOMOTIVE, FARM EQUIPMENT AND GENERAL INDUSTRIAL APPLICATIONS
GEAR-MAKERS TO LEADING MANUFACTURERS

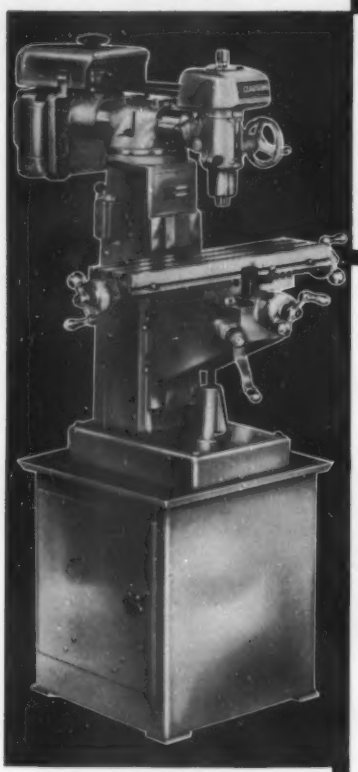
Automotive Gear Works, inc.

ESTABLISHED IN 1914

RICHMOND, INDIANA

You can cut PRODUCTION COSTS with the—

CLAUSING PLUS VALUE LINE!



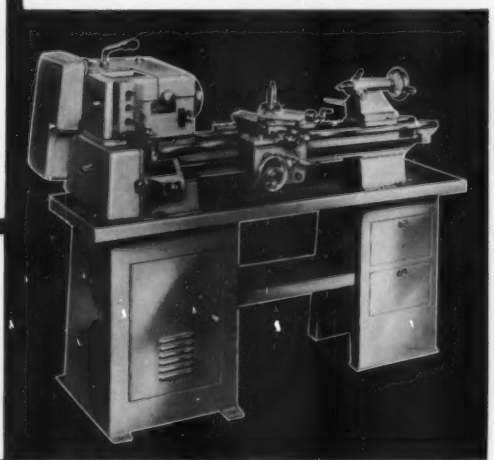
The Great New CLAUSING PLUS VALUE Lathes, Drill Presses and Vertical Millers offer you one sure way to meet today's competition through lower production costs! Feature by feature . . . dollar for dollar . . . or by any other basis of comparison these new machine tools are the leaders in their fields for Accuracy . . . Capacity . . . Versatility . . . and Economy! For heavy duty production, tool room, maintenance, experimental or research work, they are also designed to give you the maximum performance per dollar invested in original equipment and operating costs. Investigate before you buy! Write today for fully illustrated literature.

THE NEW CLAUSING 18" HEAVY DUTY *power feed* DRILL PRESS

Here's today's BIGGEST Tool and Job Capacity 18" Drill Press! A heavy-duty GEAR DRIVEN power feed that's positive and sure — No belt slippage to dissipate power. Instant feed selection — BY DIAL — No belts to position. New spindle bearing engineering, vernier depth stop, exclusive head and table positioning mechanism. Drills 1" cast iron, ¾" steel — No. 3 M.T. — 6½" spindle travel.

THE VERSATILE NEW CLAUSING VERTICAL MILLER

Especially designed for tool room, pattern shop and general purpose use, the new CLAUSING Vertical Miller is many machines combined in one! It Mills, Drills, Bores, Reams and Shapes . . . at all angles . . . with one work setup! Rigid, high precision spindle head with 7 ball bearings, chrome nickel steel spindle, chrome hardened, ground steel quill and honed bearing seats, micrometer depth control stop and two feeds. 6" x 24" table, 6 spindle speeds, 180 to 3250 R.P.M., No. 7 B&S or No. 2 M.T. spindle optional.



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THE GREAT NEW CLAUSING 5300 12" PRECISION LATHE

Here's the massive new lathe that's designed for Bigger Capacity . . . Greater Accuracy PLUS Economy! Featuring: "Zero-Precision" Timken tapered roller bearings • exclusive clutch and brake equipped countershaft • 1" collet capacity • 12" swing • 1⅜" hole through 16" long precision ground, forged steel spindle • No. 3 M.T. tailstock with tang socket • double-walled automatic apron • quick change mechanism • massive precision ground bed.

so there is a direct connection between the effort and the payment. This can be readily done if the plan is a simple one.

A common type of plan which satisfies some, but not all, of the above requirements is one known as the Indirect Financial Plan. Indirect financial incentives include such arrangements as company-wide, profit-sharing plans, plant-wide bonus plans, Christmas bonuses and provisions for extra income through employee ownership in the company. Under such plans the increase in earnings gained by the individual worker does not depend directly upon his increase in output, but rather upon the combined efforts of large groups. It is possible for an individual worker to receive increased earnings when his own relative output may have decreased. This informal type of bonus is indefinite, and usually subject to the whim of the owner or manager. These bonuses are welcomed by the employees, but they are ineffective as an incentive toward increased production. Company-wide profit sharing plans serve a useful purpose in maintaining an economic balance between wages, prices, and profits resulting from the overall prosperity of the company. A good profit-sharing plan provides an equitable distribution between the owners' interests (dividends) and the wages and salaries paid to the employees. Such plans should not, and cannot, replace direct financial incentives.

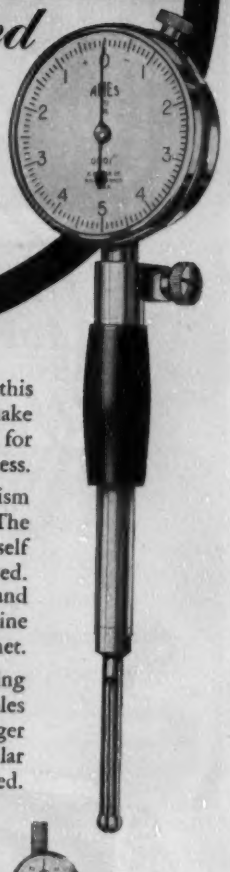
A second general type of plan is the Direct Financial Incentive plan. Direct financial incentives are those which tend to pay the worker soon after, and in direct proportion to, his individual production. Although there are many detailed variations in specific applications, there are only five or six basically different direct financial incentive plans. Each has features not contained in the others. The variations are a result of the selection of different methods of determining the normal output, and of different methods of classifying or grouping the type of work. For some work the output is directly proportional to the worker's effort. For some operations the output varies as a result of variable working conditions. The output may be affected by certain factors beyond the operator's control. For example it may be impossible to provide strictly uniform materials, or surroundings, such as temperature, humidity, dust, noise and lighting and these may affect the output. For other classes of work the output may be relatively fixed,

AMES

... the Preferred

FOR FAST, ACCURATE INSPECTIONS

Small Hole Gauge No. 36



Skilled and unskilled employees can use this superbly designed two-point contact gauge to make quick, accurate, *impersonal* inspections of small holes for size, taper and roundness.

The Ames No. 36 has extremely sensitive mechanism especially designed to eliminate "feel" in measuring. The spherical contact point automatically centers itself and indicates the true diameter at the point measured. The operator has only to slide the contact in and around the hole and note the readings to determine if tolerances are being met.

The Ames Small Hole Gauge No. 36, using contacts in increments of 1/32", can check holes of 3/16" to 1" diameter, up to 2" depth. Longer lengths and special contacts to check irregular recesses, splines, etc., can be supplied.

Ames No. 15 Jaw Gauge

Ames No. 13 Dial Comparator

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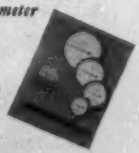
Ames No. 25 Pocket Thickness Measure

If you would like to have our recommendations on your measurement problem, send blueprints and specifications. Write for your free copy of catalog on Ames precision measuring instruments.



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OUT OUR WAY

THANKS, BURL, FOR HELPING US OUT -- I'VE PUT TWO HELPERS ON, AND ALL YOU'LL HAVE TO DO IS SIT HERE AND RUN THE WORKS!
IT MUST BE SECOND NATURE THE WAY HE HAULS OUT THAT CHAIR WHENEVER A GUY SLIPS IN THE GREASE!
YEAH -- HE'LL NEED TWO MORE CHAIRS FOR THE HELPERS IF HE DOESN'T GET SOME SOL-SPEEDI-DRI ON THAT FLOOR!
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J.R. WILLIAMS

Industry's remedy for slick, oily floors

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For clean, slip-proof floors, you can't beat "dry cleaning" with Sol-Speedi-Dri. Industry buys more of it than any other oil and grease absorbent, because pound for pound, dollar for dollar, Sol-Speedi-Dri gives *more for the money,* all factors considered. Check plants near you, and you'll see what we mean. Send coupon today for free sample and literature.

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AM7/5/54

or the maximum rate may be limited by the capacity of the machine or process.

There are still other classes of work where the output is not measurable. Typical examples include research, development, inventing, learning, and general planning activities, in which the apparent accomplishment does not necessarily indicate the effort expended.

This listing of different classes of work illustrates just one of the problems of the direct financial incentive plan. In spite of these difficulties we lean toward this type of plan. It is our feeling that the most important part of the plan is that whenever the job permits, the worker should be paid in direct proportion to his output. He or she should receive the incentive payment promptly and the individual worker should know how to calculate his or her own incentive pay.

William Martin
Brooklyn, NY

•

DECIMAL DITHER

Which is easier for all-around shop use — decimals or fractions? Would the average shop man rather write or read a dimension as 33/64 in., or as 0.515625? Does the extreme accuracy of the decimal system counterbalance the familiarity of long-time use of fractions?

THE DECIMAL SYSTEM is nothing new in large machine shops. It was in use in 1898 for instance, and, as Ed says, it is not at all satisfactory for the usual run of machine shop work.

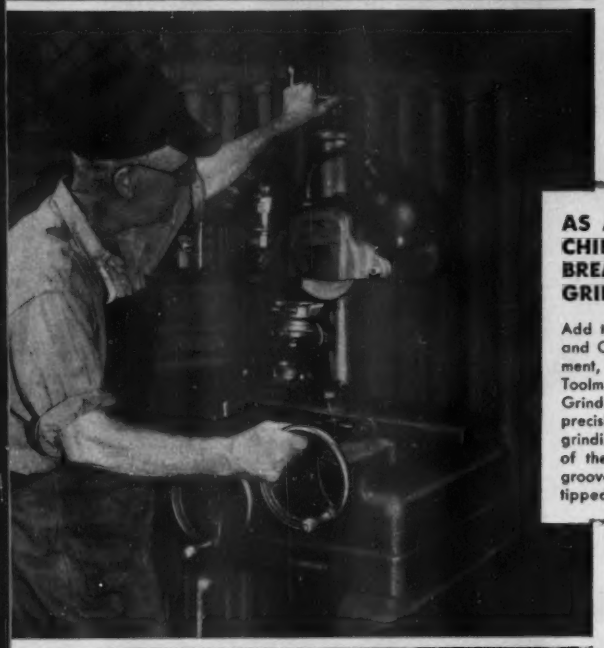
"Hope the new foreman is better than ol' Tom. Whew . . . I can still feel him breathing down my neck."

3 PRECISION GRINDING OPERATIONS

ON 1 RUGGED, ROCKWELL-built DELTA Toolmaker® GRINDER

AS A STANDARD SURFACE GRINDER

The basic DELTA Toolmaker Surface Grinder is a big, rugged machine with the massiveness and solidity required for surface finishing in tool room or production line.



AS A CHIP-BREAKER GRINDER

Add the Univise and Coolant attachment, and your Toolmaker Surface Grinder is a precision machine for grinding all angles of the chip-breaker groove in carbide tipped tools.

AS A TOOL AND CUTTER GRINDER

Holding your work either in the Unihead or between centers, your Toolmaker Surface Grinder is equipped to economically grind and sharpen tools and cutters to original specifications.

In your plant, 90% of the precision grinding operations can be economically handled by DELTA Toolmaker Surface Grinders equipped with three inexpensive attachments. With these accessories: a coolant attachment, a Univise®, and a Unihead®, you can maintain consistently high grinding and sharpening output of milling cutters, reamers, taps, saw blades, etc. — both high speed steel and carbide-tipped cutters. All this is in addition to the extremely accurate surface finishing obtainable with the DELTA Surface Grinder itself.

Placed in appropriate positions throughout your plant, DELTA Toolmaker Grinders effectively eliminate the "Toolroom Bottleneck." Their low initial cost, dependable accuracy, and rugged construction make them ideal where the demands of fast production and absolute accuracy are inseparable.

Learn how these and other Rockwell-built DELTA tools can save money in your plant. Get in touch with your DELTA Dealer; he's listed in your classified directory under "Tools" or "Machinery."

Delta Power Tool Division, Rockwell Manufacturing Company, 618G North Lexington Avenue, Pittsburgh 8, Pa.

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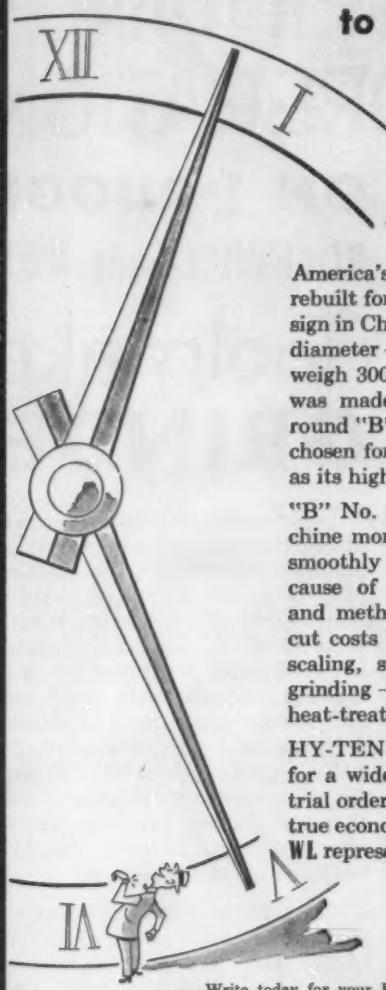
Another Product by **Rockwell**

DELTA QUALITY MAKES THE DIFFERENCE DELTA ROCKWELL

OVER ONE HUNDRED YEARS OF CONTINUOUS SERVICE. ROUNDS, SQUARES, FLATS, HEXAGONS, OCTAGONS, BILLETS AND FORGINGS FOR PRODUCTION, TOOL ROOM AND MAINTENANCE REQUIREMENTS

it's the right time

to Investigate the Qualities of HY-TEN ALLOY STEEL



America's largest clock was recently rebuilt for a spectacular illuminated sign in Chicago. It measures 50 ft. in diameter — hands and movement weigh 3000 lbs. The new driveshaft was made from 6 ft. of 3½-inch round "B" No. 3X heat-treated bar, chosen for its machinability as well as its high physical properties.

"B" No. 3X heat-treated bars machine more readily and finish more smoothly than standard alloys because of their particular analysis and method of manufacture. They cut costs by eliminating distortion, scaling, straightening — and often grinding — as well as the cost of heat-treating finished parts.

HY-TEN "B" No. 3X bars are used for a wide range of applications. A trial order will convince you of their true economy. Just call your nearest WL representative.

Write today for your FREE COPIES of Wheelock, Lovejoy Data Sheets, indicating your title and company identification. It contains complete technical information on grades, applications, physical properties, tests, heat treating, etc.

137 Sidney St., Cambridge 39, Mass. and Cleveland • Chicago • Detroit Hillside, N. J. • Buffalo • Cincinnati

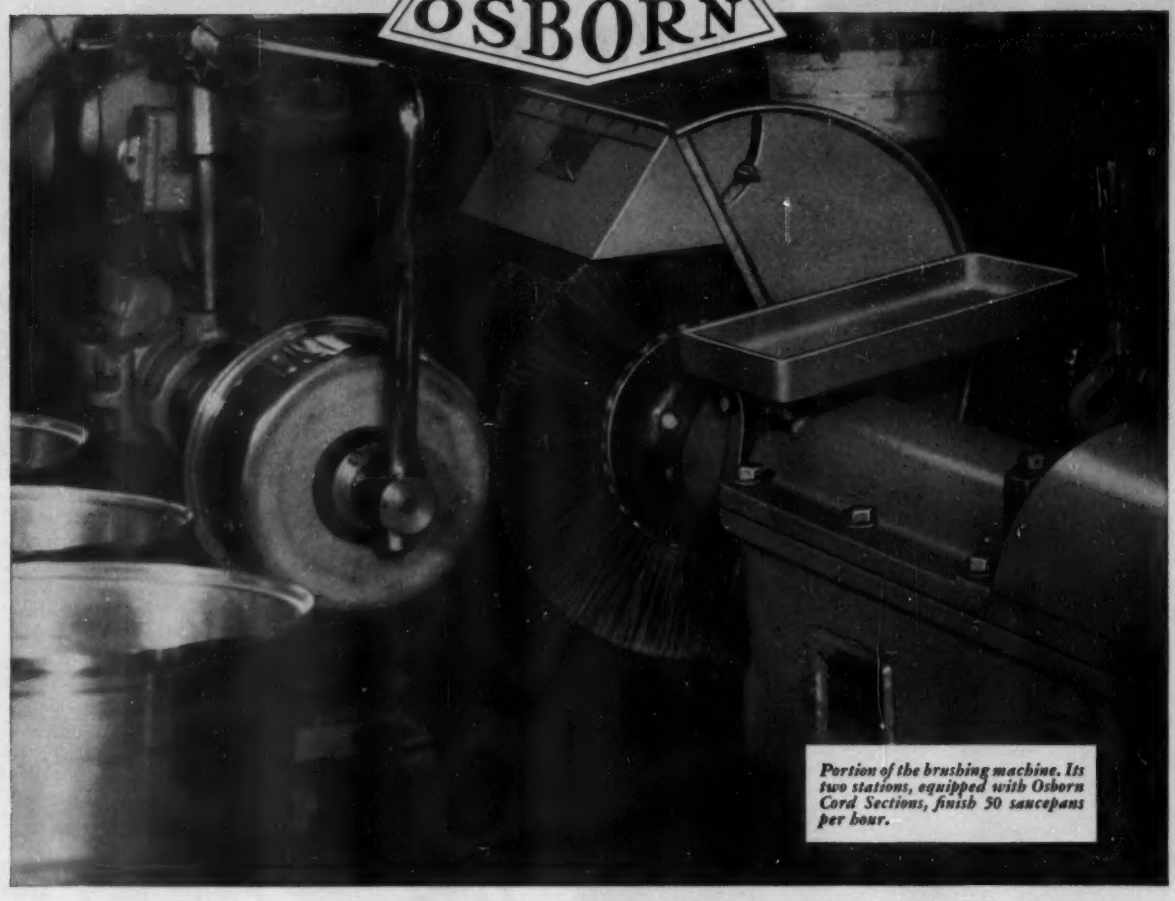
I think everyone will agree, for example, that it is a lot easier to mark a dimension 33/64 in. than it is to put down 0.515625. They both mean exactly the same size and, if it is for a drilled hole, the drill will be marked with the fractional dimension. If the hole is simply for a ½-in. clearance, and to avoid marking a decimal dimension running into the millionths of an inch, the draftsman may stop at the thousandths and mark 0.515, but then the toolroom expert will state that there is no such drill and it will be necessary to grind one to the special diameter and thus ruin a good drill and unnecessarily run up the production cost.

A good designer will always attempt to dimension everything so as to permit the use of standard stock tools, such as milling cutters, reamers, etc, to keep the production costs down. For this reason he will try to keep all dimensions to the English Standard fractional sizes; thus the job can be put through the shop at a minimum cost. Of course at times a fractional dimension will not answer, then the decimal must be used, so in this case a decimal figure is used and the fact that a decimal dimension is shown immediately indicates to the workman that it is an important figure and he must work to micrometer measurements according to the number of decimal places indicated.

Tool and die work, because of its close tolerances, is often dimensioned in decimals and, unless otherwise noted, the tolerances are ±0.0005. Ordinary machine shop jobs are nearly always in fractions and in this case the tolerance is 1/128 in. Precision work is almost always dimensioned in decimals and sometimes has tolerances of 0.00001 or even closer on precision gages.

"He just took half an hour to bawl me out for being two minutes late."

OSBORN



Portion of the brushing machine. Its two stations, equipped with Osborn Cord Sections, finish 50 saucepans per hour.

Recipe for cooking up a 33% saving

HERE'S how to make stainless steel shine in *two* steps where it formerly took *three:*

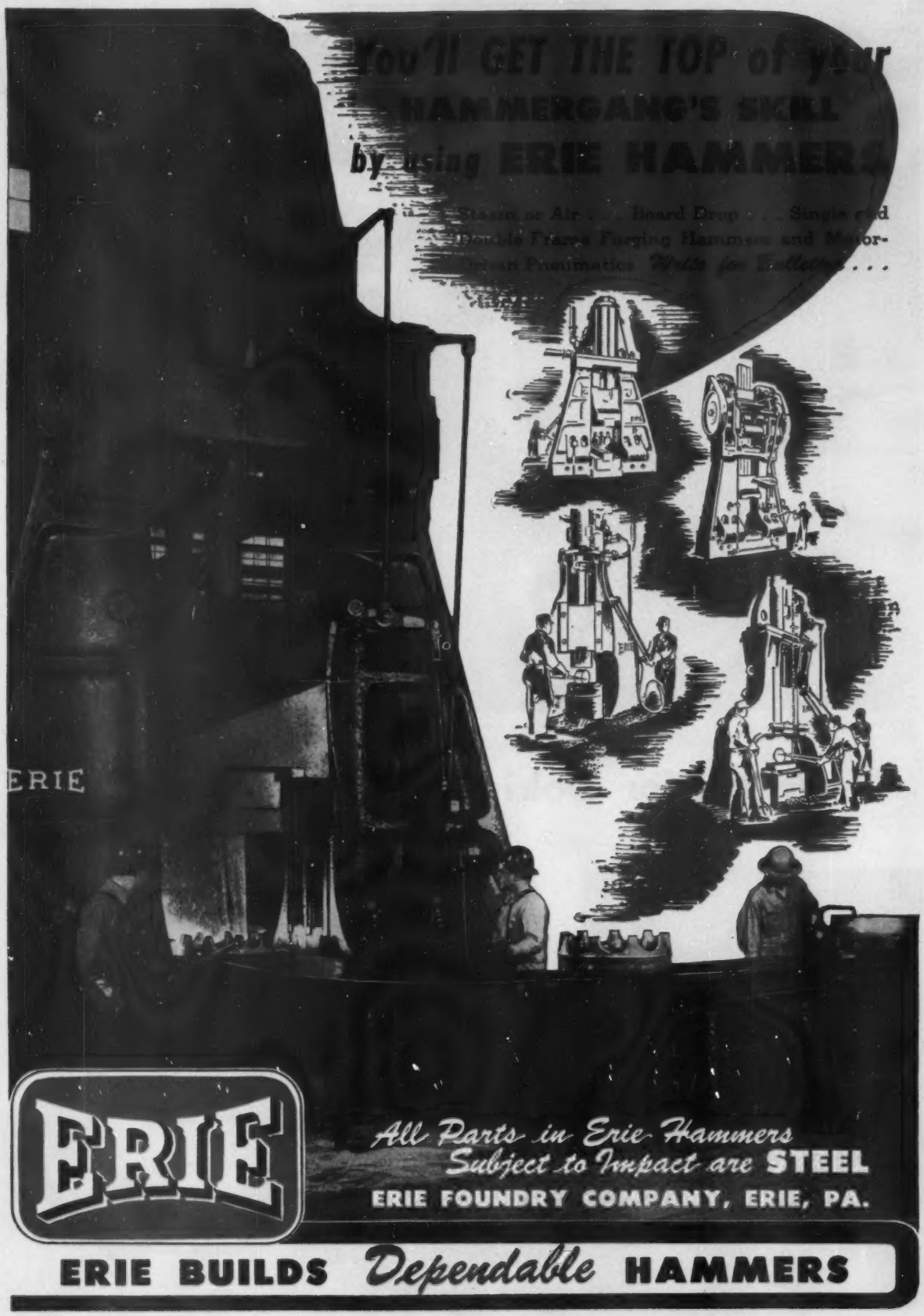
This manufacturer of stainless utensils used these operations: (1) Rubbing with 220 oiled grit. (2) Rubbing with 320 oiled grit. (3) Buffing. The **O**sborn **B**rushing **A**nalyst suggested the use of Osborn Cord Sections with stainless steel cut and color compound instead of operations (2) and (3).

Results: The finish is perfectly uniform. Finishing time has been cut 33%.

This is typical of savings being made in finishing of many materials and many products with Osborn Push-Button Brushing methods. Find out how *you* can save. Call your nearby **OBA** or write *The Osborn Manufacturing Company, Dept. C-20, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

Osborn Brushes

OSBORN BRUSHING METHODS • POWER, MAINTENANCE AND PAINT BRUSHES • BRUSHING MACHINES • FOUNDRY MOLDING MACHINES



ERIE

All Parts in Erie Hammers Subject to Impact are **STEEL**

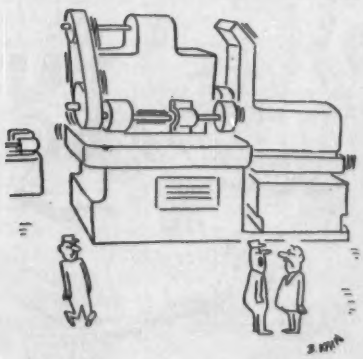
ERIE FOUNDRY COMPANY, ERIE, PA.

ERIE BUILDS *Dependable* **HAMMERS**

Before graduated rules were common, the width of a thumb lightly pressed on a board was used for one inch or, if greater accuracy was desired, then three barleycorns placed end to end were considered one inch. For larger measures the first sixteen men who came out of a church placed their right foot toe to heel and the total distance was taken as sixteen feet and this halved four times gave the foot dimension.

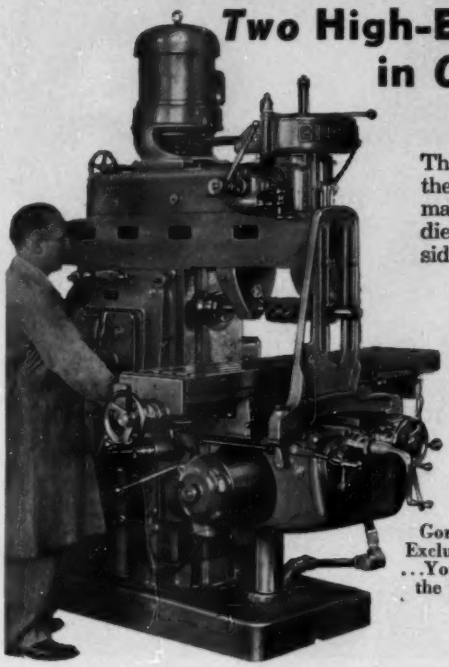
The meter is not such a good measure as many people suppose. In the first place the original meter France tried to establish was intended to be one ten-millionth part of the quadrant of the earth's meridian or the distance from the equator to the pole passing through Paris, but they missed the distance by a serious error—so now it is simply the distance between a couple of lines on a platinum-iridium bar. The length of this meter is 39.370113 inches but the US Congress decided that so much accuracy was not needed and passed an act in 1866 which declared the meter to be 39.37 inches. There are, however, a lot of meters around; Capt AR Clarke established one at 39.370432 inches in 1866; The US Ordnance Corps used 39.3707971 inches; The US Coast Survey used 39.37043235 inches, so there seem to be all kinds of meters and centimeters around and since they do not divide as conveniently as the inch, there does not seem to be any particular advantage in changing from the inch to the centimeter for engineering practice. The inch and its fractions will probably be used for a long time to come, with the exception of any work which requires tolerances of less than 1/128 in., then the decimal inch comes into use. Thus Ed and Al are both right on this question.

George P Pearce
Albuquerque, NM



Wonderful machine . . . does three times the amount of work any of our others do . . . stop button's broken.

New Gorton 2-28 Brings You *Two* High-Efficiency Mills in *One* Money-Saving Unit



. . . as a horizontal mill.

The Gorton Receptor Ram makes the new 2-28 a true multi-purpose machine . . . "tailor-made" for *all* die-mold-machine shops. Consider the facts:

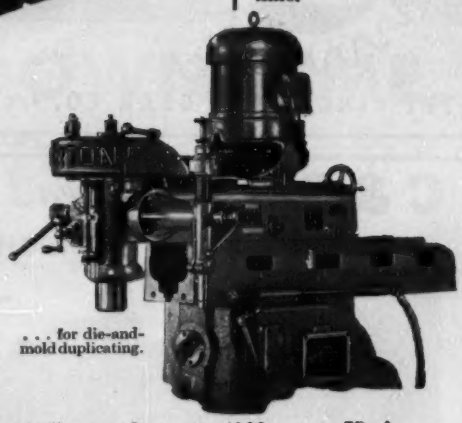
HORIZONTAL MILL

VERTICAL MILL (Super-speed)

DUPLICATOR (Simply add a duplicator head and a duplicator table.)

NOTE: You can switch from horizontal to vertical high-speed milling in 5 minutes or less. Save space and capital equipment — and increase production facilities at the same time.

Gorton Exclusives . . . Yours in the 2-28



. . . for die-and-mold duplicating.

- Fullwidth knee, 24½ inches wide, provides extreme rigidity. Even under heavy cutting loads, there's no sag or twist.
- New lubrication system dissipates heat to prevent spindle "growth" . . . to promote full use of spindle horsepower . . . to end the necessity for adjusting cutter depth to compensate for differences between "hot" and "cold" operation.
- High-speed head delivers spindle speeds up to 4000 rpm. Horizontal spindle: up to 2000 rpm — 7½, 10 or 10/5 hp *at spindle nose.*
- Double-extension feature of the Receptor Ram greatly increases work area, vertical capacity and transverse cutting capacity on either the Gorton 2-28 or 3-34 Horizontals.
- Down time and maintenance are drastically reduced by *true* unit construction features. A removable coolant pan speeds sump cleaning and coolant changing.
- Overload protection automatically safeguards expensive cutters. A horsepower-load meter constantly indicates cutter condition and operating efficiency.
- Full directional front and rear controls are interlocked.

You can't afford to overlook this Gorton Horizontal with Receptor Ram. It could produce more profit per dollar invested than any other machine you have. Fill out and mail the coupon.

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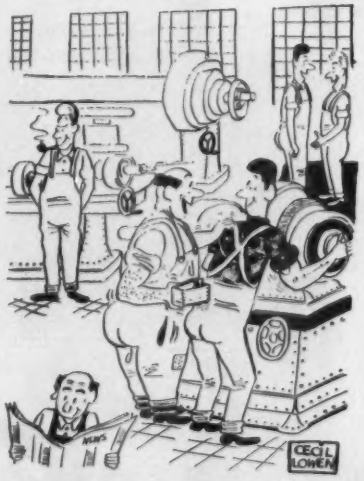
WELL AL AND ED have gotten hold of a problem which is common to just about every shop. This is a real live problem and one that I would like to see settled.

According to the American Standards Association, dimensions of parts that can be measured or that can be produced with sufficient accuracy by using an ordinary scale should be written in units of common fractions. Parts requiring greater accuracy should be dimensioned in decimals. Accurate dimensions which are to be established with limit gage or micrometer should be expressed in decimals to at least three places and the drawing should give the limits between which the actual measurements must come. This method should be used for smaller parts and where gages are used.

A second method, used for larger parts and where few gages are used, is to give the calculated size to the necessary number of decimal places, followed by the tolerances, plus and minus. There are many parts produced where scale accuracy is sufficient; in these cases there is no question but to use fractional dimensions on the prints. There are other parts where all dimensions are held close. In this case all dimensions are best given in decimals.

But what of the great volume of parts which do not fall into these catagories; parts where scale accuracy is sufficient on some dimensions, but the other dimensions require decimals? The usual procedure is to use both fractions and decimals on the print of such a part. The standard tolerance on the fractions and decimals is usually covered by a note



"It's a collection to let the boss stay in Florida another two weeks."

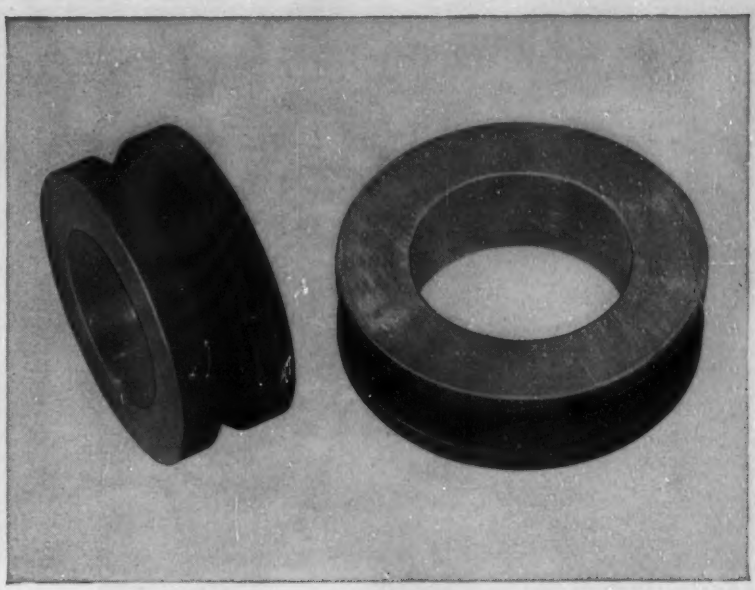
on the drawing. The usual tolerances are ± 1/64 for fractions and ±0.005 for the decimals. Where a different degree of accuracy is required it is necessary to apply the tolerance directly to the dimension. This means that the drawing carries fractional dimensions with tolerances, fractional dimensions without tolerances, decimal dimensions with tolerances and decimal dimensions without tolerances. In addition, the tolerances on the fractions are sometimes given as decimals.

It is very clumsy to give limiting dimensions in the form of fractions. Therefore the drawing may carry fractional dimensions with decimal tolerances on some portions of the drawing and limit dimensions on other portions of the drawing. Each of these methods of dimensioning has certain merits, but they each have limitations and failings which necessitate the use of various methods of dimensioning on one drawing.

The only real solution and the one that has been talked about for years and years is the introduction of the metric system. It has a great many advantages and European countries are grateful to Napoleon for forcing the changeover to the metric system in France and other countries.

The metric system is widely used in this country for scientific work, but I do not think that it will ever be adopted by industry as a whole. Every machine or tool or product which is going to be built in the future is a reason for changing over to the metric system. Every machine or tool or product which has been built to the English Standard (or inch standard) and is in existence at the present time is a reason for not changing. These machines are made to the English Standard and produce parts to the English Standard. As time goes on we will have more and more machines in use and therefore more and more reasons for not changing to the metric system. It is true that the number of machines which we contemplate building in the future is also growing, and of course the number to be built exceeds the number in existence at the present time. Each of these future machines is a good reason for adopting the metric system; however, they are in the future and cannot apply the pressure which is applied by the existing machines.

It looks somewhat dismal, but there is a ray of hope. I believe the answer is a simple one, and one that is already in use in some large integrated organizations. This solution is the system of using scales divided into inches and 10ths and 50ths of



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Flame-Plating is a new LINDE process for applying wear-resistant coatings of tungsten carbide to the wear surfaces of parts and many tools made of most common metals. For the full story on how you can solve your wear problems with Flame-Plating, read the new "Flame-Plating" booklet.

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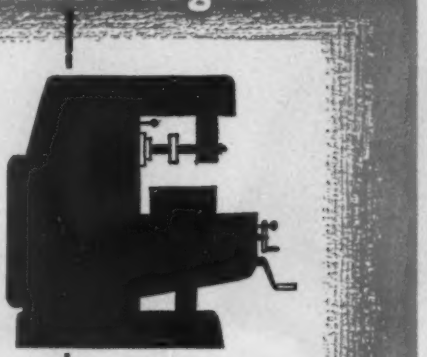

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an inch. These scales are readily available and are convenient and easy to use. With them the dimensions can be scaled off directly in inches, tenths, and hundreds. The scales are usually divided into 50 divisions to the inch but the divisions are numbered as though there were 100 divisions. This makes it very easy to read directly in 100ths. These scales eliminate the use of fractions entirely. They permit dimensions which only require "scale" accuracy to be indicated on the drawing by giving dimensions to two decimal places. These dimensions can carry a standard shop tolerance or the tolerance can be indicated. More precise dimensions can be given to three decimal places, once again with the standard shop tolerance or with the tolerance indicated.

This system is very easy to learn and would not require any changes in dial gages or feed screws, etc. The changeover to this system could be a gradual one and could be accomplished without undue confusion. I hope to see the day when it is in general use.

William Martin
Brooklyn, NY

•

ARE some people too pessimistic about shop acceptance of decimals? Are decimals really easier and quicker to use, or are fractions best because they have been with us so long?

Let us look at the situation from the angle of a toolmaker or machinist. He is the man who has to worry about dimensions on a blueprint after it has left the engineering office. It is almost impossible in this

". . . As your time study expert, let me show you a few things I learned about YOUR work habits . . ."

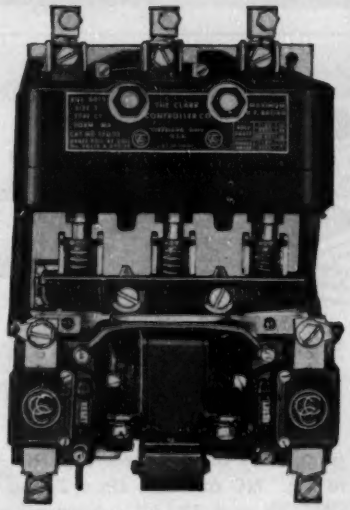
PROOF OF LOW MAINTENANCE ON CLARK TYPE "CY" STARTERS

These unretouched photos show contact tips from a CLARK Bulletin 7707 contactor—the contactor used in the standard Bulletin 6013 size 2 AC Motor Starter — as they looked before and after a year of hard use.

The contactor is in service at Cleveland Hone and Manufacturing Company, on a special transformer and rectifier circuit used in processing automotive parts. The tips shown right above were removed from the contactor after 12 months of steady service, often operating as frequently as 5000 times per hour.

Note that slight discoloration and minute pitting are the only evidence of wear. They require no cleaning, dressing or filing, and are in condition to give many more years of dependable service.

The secret of long contact life in the CLARK Type "CY" Starter is its exclusive arc-quenching principle, using strong multi-turn magnetic blowouts and double-break contacts. Forced rotation causes the arc to move continually on the contact surfaces, distributing the heat and preventing pitting or "build-up" at any one point. Result: extremely effective arc interruption, and greatly reduced wear on tips.



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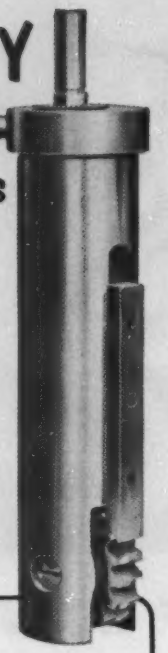
The INSIDE STORY about NATIONAL Keyseating Millers



NATIONAL Keyseating Millers are designed for milling internal keyseats . . . in one cut . . . in offset holes . . . with parallel sides . . . partly through holes . . . of standard width and depth . . . in holes that are closed at one end . . . and many other operations that a keyseating machine can't reach. A demountable guide on body of Miller enters keyseat being milled assuring straight keyseat in perfect alignment with the axis of the bore, thus making it unnecessary to clamp work to drill press table.

CUTTERS are made from high speed Rockwell hardened steel, accurately ground to size. Tops of teeth are staggered to break chips which reduces strain and wear on both cutter and driving pins. It will pay you to put National Keyseating Millers on the inside of your next keyseating job.

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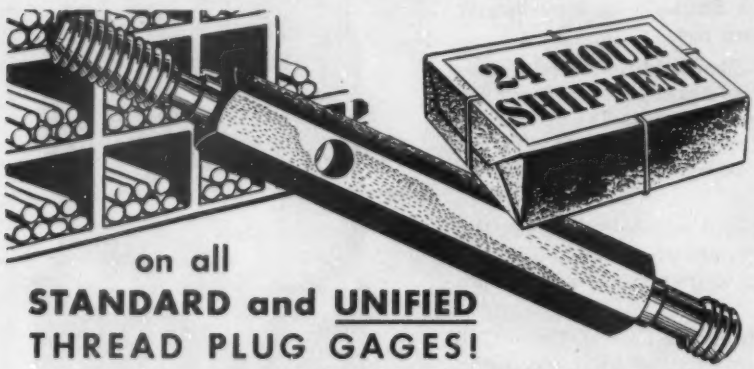

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century of advanced machines and tools with which parts can be produced to unbelievably close tolerances to design and draw up a part without using decimal dimensions. It many occur once or twice in a hundred cases that a piece to be produced in a machine shop has sections which can be described with fractional dimension only. In most instances the decimal cannot be avoided. It is evident that nowadays with the development of new and more compact and intricate devices, greater variation in the dimensioning of the components exists.

A toolmaker or machinist when he gets a print for a new job will automatically look for the tolerance markings and decimal dimensions after he has taken in the over-all picture of the part. His immediate reaction will be a survey of possibly difficult operations in the production of the piece in connection with these. The fractional markings will be regarded as of minor importance and in many cases interpreted as more or less rough measures. It is a natural behavior for a trained man to look for the seemingly important factors first and to group his thoughts around same, sacrificing some consideration for the other dimensions, mostly just as essential.

A result of this is that pieces have been turned out on which all whole-number sizes checked right on the dot, but the fractionals varied widely within or above the given tolerance limits. It will be often found that men questioned about these discrepancies will reply that the dimensions were just given in fractions and there was nothing fussy about them, and the engineering department better give all measurements which are to be held close, decimally, in future.

In view of this, the conclusion can be reached that if a drawing requires one or more figures in decimals, it is

"Blueprint calls for a taper on this shaft, so I'm pushing the rear end of the lathe over two inches so I can cut it."

wiser to make the whole in such. Since we have found that it is hardly possible to stay away from this type of specification, it stands to reason that it can and will be accepted by most shops, even the ones that are still using as many fractional dimensions as possible on their prints either because they don't like to trouble their toolmakers with a different system or because they are loyal admirers of a complicated calculation.

As to the second question: "Are decimals really easier and quicker to use?" If it can be safely said that they are, then how many people in the trade know, without following a chart for 10 seconds or more, how much 47/64 in. are in decimals?

Who will guarantee, that a man looking at this chart does not read 49/64 in. instead, particularly if he has just strained his eyes on the fine calibrations of a machine. Is it always arranged that a chart hangs in a place where the toolmaker can see it well from his bench or the spot he is working? Is the light always so good, that the numbers can be read from a fair distance? Do not many of our older workers wear glasses for close sight only?

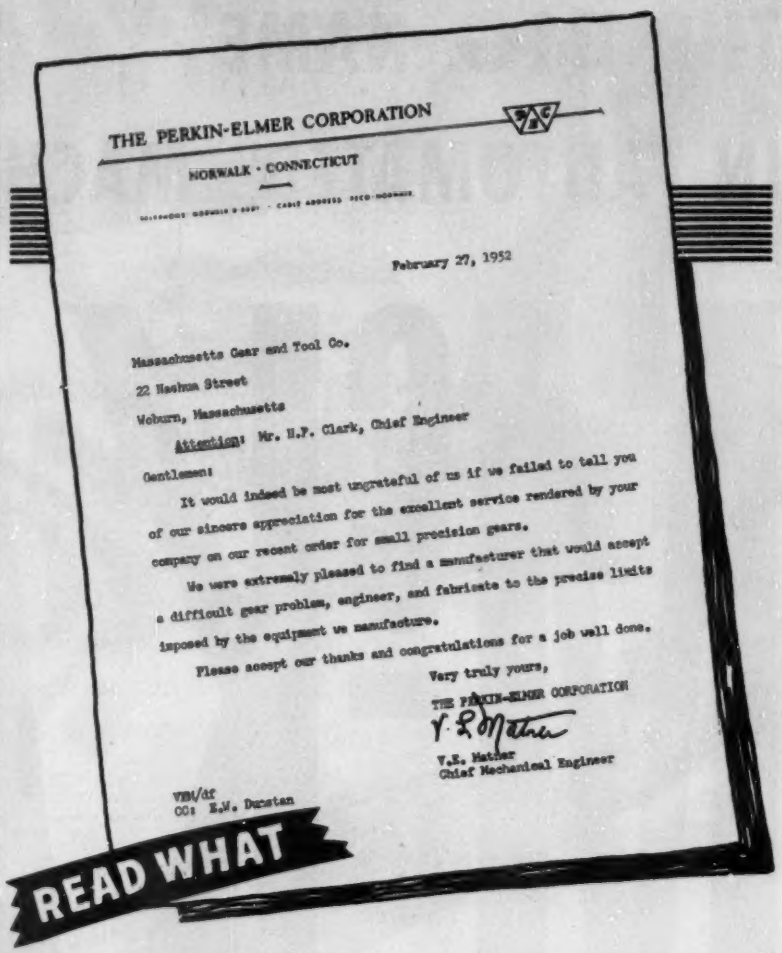
If all these questions are considered, it can well be established that in most instances the straight-forward usage of the whole number system will eliminate errors, save time wasted by men walking back and forth to see the chart or looking at the small markings on their micrometers (if they are of expensive make and have a decimal equivalent engraving) and most important, provide uniform and simple communication between shop and office.

Many old tradesmen will say: "What's wrong with the old routine?"

Well, there is only one thing wrong with the old routine; it is not flexible enough and cannot express critical points close enough. There is nothing wrong with it in the lumber or constructive steel business, but in the tool and machine-building field it is just not fine enough.

And is it really so hard to make a switch to the decimals? Why should it be? Look at all the thousands and thousands of Europeans on this continent,—most of them did not know how long an inch was before they came to this country. They have adopted the English system without trouble and in practically no time at all. However, there is a much greater difference between the metric and the inch measurements than there is between fractions and decimals. If they can do it—we can do it.

H Franzkewitch
Buckingham, PQ, Canada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Attention: Mr. H.P. Clark, Chief Engineer

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V.E. Hatter
Chief Mechanical Engineer

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New Books . . .

LINEAR SCALE NON-LOGARITHMIC SLIDE RULES—*By Morris L Groder. Published by G & G Corporation, 2003 East 12 St, Brooklyn 29, NY. 64 pages, 5¼ x 8¼ in., paper bound. Price $2.98*

You can construct a slide rule for multiplication and division in less than half a minute by following the technique outlined in this book. The only tools needed are a straight-edge, a pencil, a compass and a sheet of cross-section paper. Further instructions show how to obtain squares, square roots, sines, cosines and tangents with this slide rule. However, there is some doubt whether this method is more convenient and as accurate as the conventional slide rule.

•

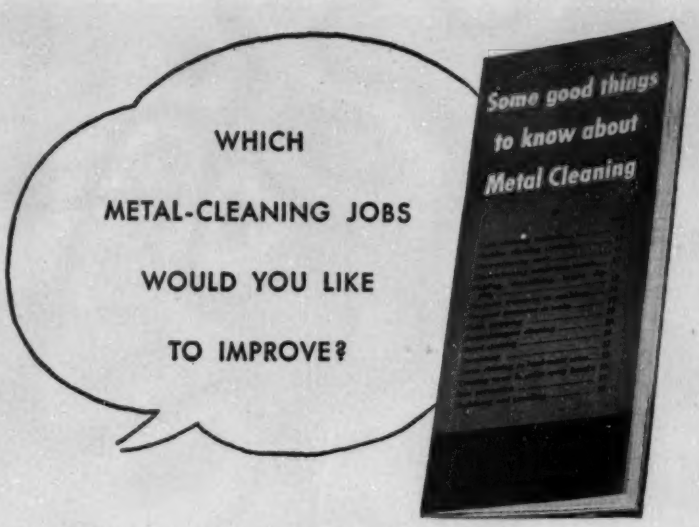
GENERAL SHOP—*By Chris H Groneman and John L Feirer. Published by McGraw-Hill Book Company, Inc, 330 West 42 St, New York 36, NY. 307 pages, 6¼ x 9¼ in., hard cloth bound. Price $3.56*

An ideal book for the Industrial Arts student and instructor, as well as the do-it-yourself hobbyist. It has been written in simple, clear and to-the-point language. Instructions are given in drafting, designing, correct techniques in the shop, and on the use of common hand tools and machines. Shop subjects and accompanying projects cover the woodworking, metalworking, electrical, plastics, leathercraft, and home-maintenance field.

•

"TIMING" BELT DRIVE ENGINEERING HANDBOOK — *By Richard Y Case. Available through Chas R Weimer, US Rubber Co, Rockefeller Center, NY 20, NY; or Frank Tilley, NY Belting & Packing Co, 1 Market St, Passaic, NJ. 189 pages, 5½ x 6½ in. Price $3.50.*

This is an engineering handbook on the Gilmer "Timing" belt, a proprietary product. It gives history, basic design, standard types, pulleys, length and width calculations, applications, and a series of tables in the appendix. It is devoted to this one belt type, but is quite exhaustive on its applications to metalworking and other machines.



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GRAPHICS IN ENGINEERING AND SCIENCE
—By A S Levens, professor of Engineering Design, University of California (Berkeley). Published by John Wiley & Sons, Inc, 440 Fourth Ave, New York 16, NY. 696 pages. Price $7.

Orthographic projection, technical drawing, and graphic solutions are covered in this text designed for a student before he takes up mechanics, strength of materials, and machine design. It is intended for early college work, and is based on a working knowledge of simple mechanical drawing.

The book is concerned with shapes, and how to show them — projection, auxiliary planes, symbols, sketching, monographs, graphic calculations. In the back of the book are many tables, with trig functions, hyperbolic logs, thread-series dimensions, drill sizes, hole-size limits, and other valuable design data.

Mechanical shapes of machine parts are widely covered, with such items as nuts, cams, gears, and levers shown and developed in many ways to show the variey of graphic illustrations possible. Material in the book is actually adequate for reference purposes in a design office, and is well enough organized that information is readily available.

•

HANDBOOK OF STANDARD TIME DATA
—By Arthur A Hadden and Victor K Genger. Published by the Ronald Press Co, 15 E 26th St, New York 10, NY. 473 pages, 6 x 9 in. Price, $10

There are several ways to find standard times for machining operations. This book indicates one such way. Given here are extensive tables of detailed time-study information for almost all the common metalworking processes, from lathe-turning to arc-welding and assembly.

Data is voluminous. For example, in the section on lathe-turning, time data on feeds (in. per min) starts 0.0001 ipr, and is tabulated in increments of 0.0001 in. to 0.010 ipr. Then data are given in increments of 0.010 ipr, to 0.050 ipr. RPM in this section start at 10.0, 10.2, 10.5, 10.7, and so on, and finish at 9430, 9670, and 10,000 rpm.

This method of tabulating serves two purposes — reducing the chance of errors resulting from using the "formula" type of calculations; and speeding up finding of data.

Data are taken from "extensive time studies," and are intended to

furnish a means of finding required times for all elements of a machining operation without needing stopwatch studies (with their attendant expenditure of time). The result is a sort of "synthetic," or deduced, standard, which may be more nearly correct than a stopwatch study if the man being studied is clever and trying to deceive the time-study man.

Only repetitive jobs are included in this book, because it would be impractical to list all the non-repetitive kinds of work.

Also included in the data sheets are setup, deburring, and handling times for each kind of operation, and tables which aid in picking the best feeds and speeds for machining different materials.

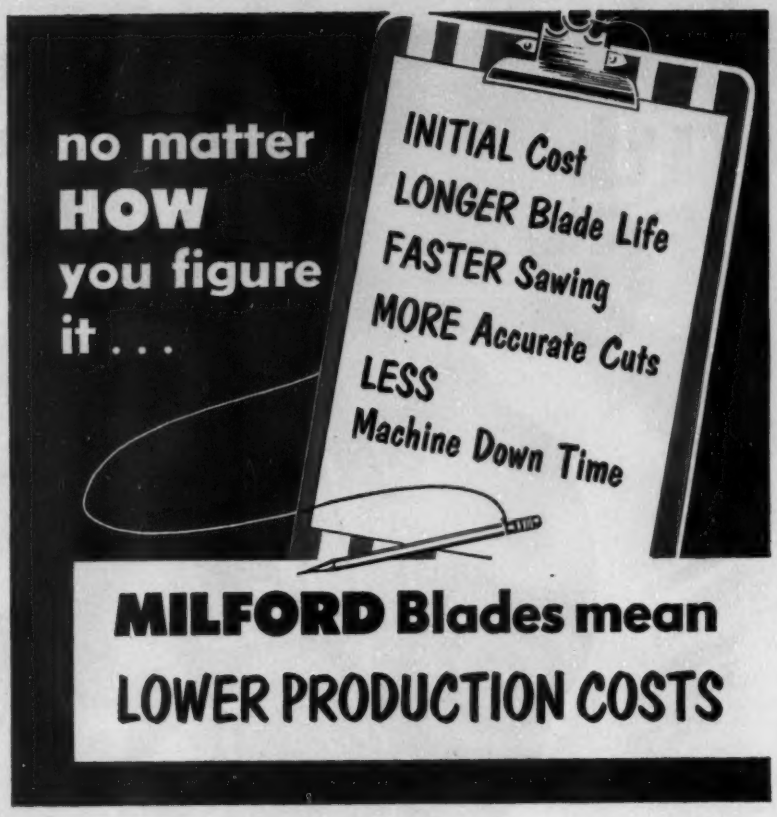
As is true of any book about averages, there will be exceptions to the time standards found here. Such exceptions do not make the method useless, but merely serve to keep the time-study man aware that he is using a guide, not a guaranteed key to the solution of his problems.

•

STUDY OF HARD COATING FOR ALUMINUM ALLOYS — *By F G Gillig, Cornell Aeronautical Laboratory, Inc. Published by Wright Air Develop't Center, US Air Force, as WADC Technical Report 53-151, and available from US Dep't of Commerce, Office of Technical Services, Washington 25, DC. 113 pages, 8 x 10½ in. Paper cover. Price $2*

This extremely detailed report covers a complete research project on the effects of hard oxide coatings produced by the MHC process on the properties of five wrought and two cast aluminum alloys. Virtually every property was investigated, from abrasion and wear resistance to electrical conductivity, and even such factors as rain erosion and gunfire penetration were checked.

Abrasion resistance was found to be far in excess of that produced by standard anodizing and to be equal to that produced by thin cyanide coatings on steel. On the other hand, the coatings produce a drastic lowering of fatigue strength, which may be as much as 65% of the strength of the base metal. This, however, depends to a great extent on the base material and is negligible on the cast alloys 220 and 356. Wear resistance is better than case-hardened steel and hard chrome plate. Corrosion and heat resistance are high, and the coating acts as an electrical insulator. Cost of producing the film is little more than that of normal anodozing.



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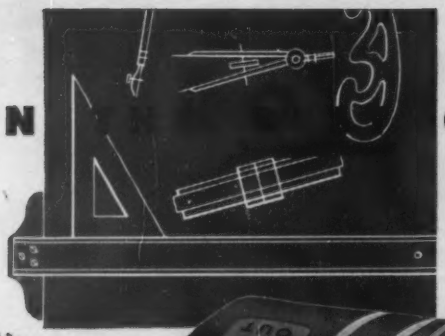
EVEN  **CAN BE IMPROVED**

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QDB .75	.84	.80	.78	.73	.66
QDB 1.5	1.67	1.62	1.57	1.50	1.42

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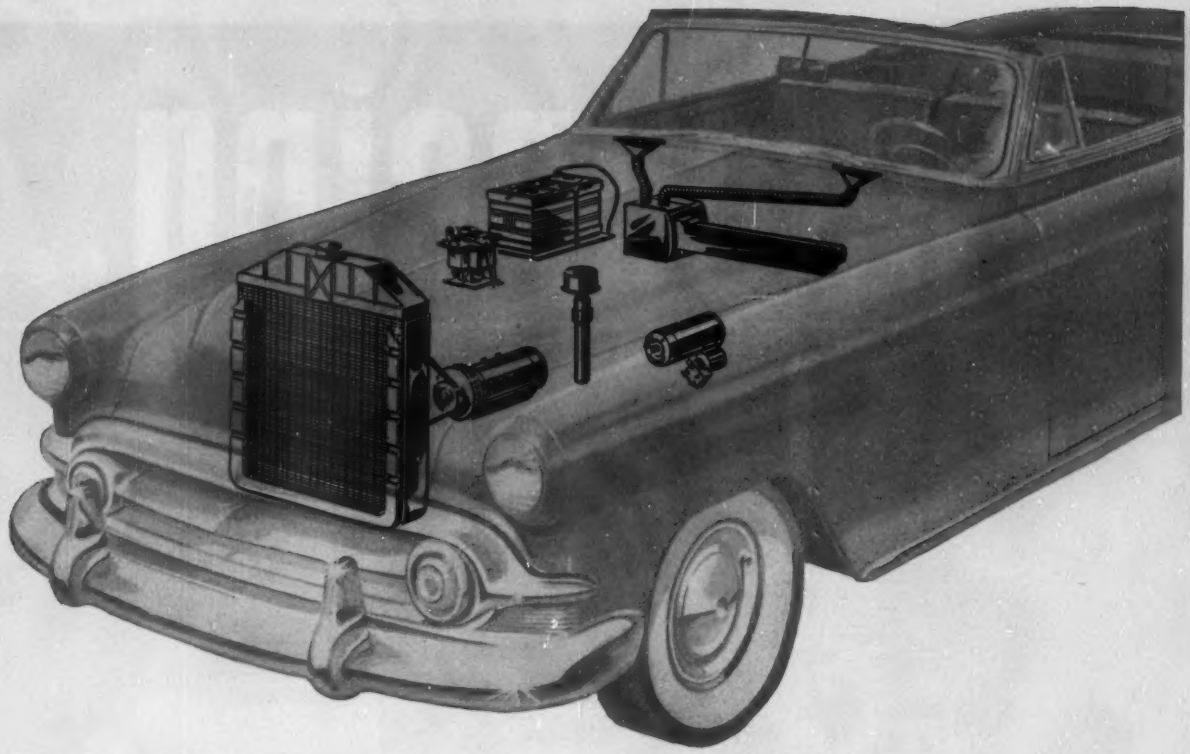

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A remarkable new series of soldering fluxes has been developed by McCord Corporation, one of the largest builders of automotive radiators, refrigeration and air conditioning surfaces, that makes possible greater economy and efficiency in production of soldered components.

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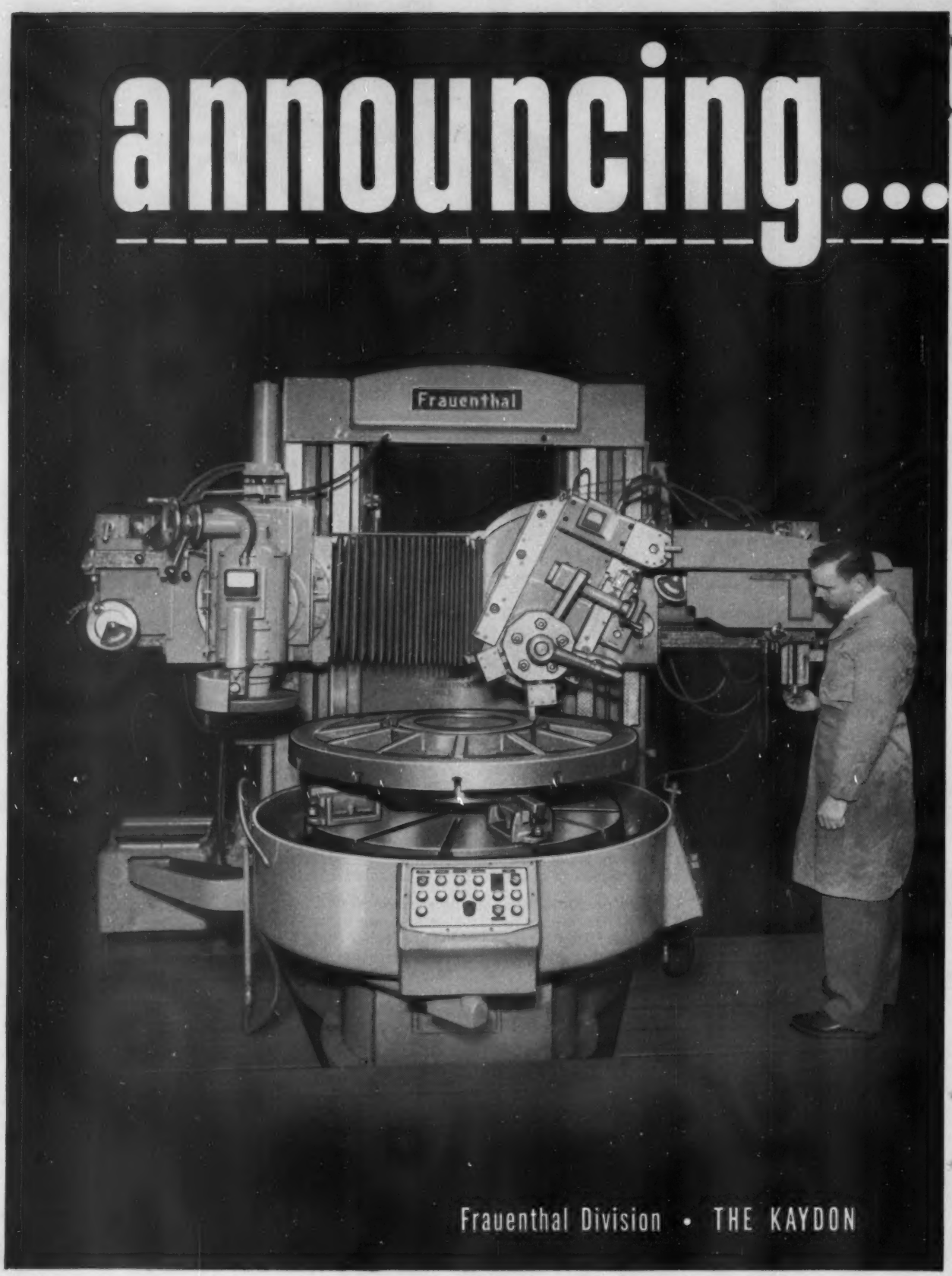

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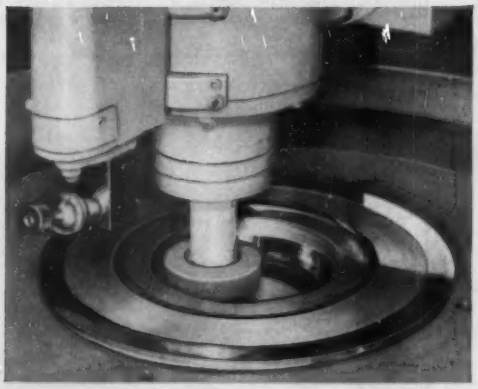
- Conveniently located controls and safety switches

... AND THIS OPTIONAL EQUIPMENT

- Hydraulic tracer control
- Electronic surface speed control
- Hydraulic wheel dressers for varied applications

Here, the operator uses a Series 3100 machine to bore out the inside diameter.



This closeup shows how the machine performs close-tolerance finish grinding of the workpiece's top surfaces and inside diameter.

May we help you?

If you'd like to have details on how the Series 3100 can offer you new tool room or production benefits — our engineers are at your service. Write for informative bulletin No. 301.

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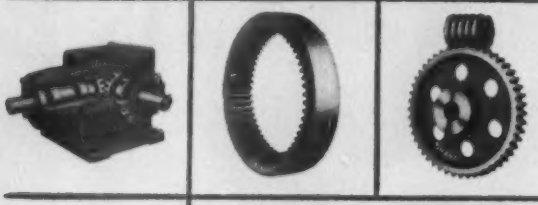

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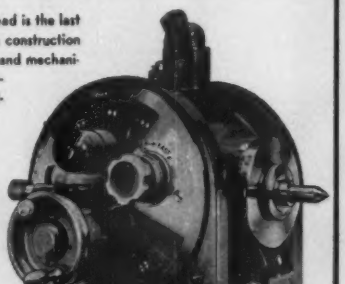

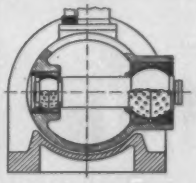

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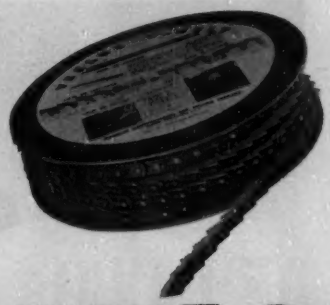
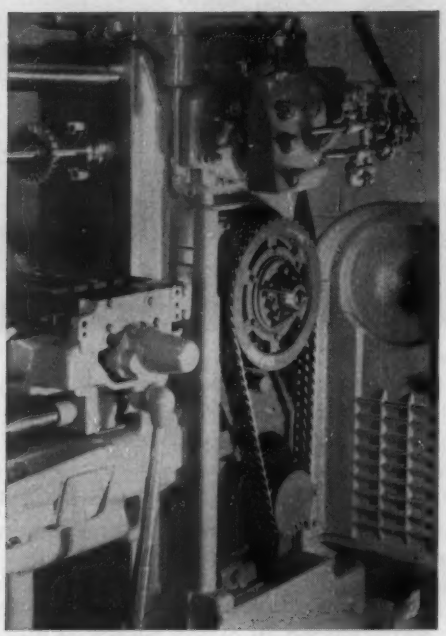


Can Veelos V-Belts

CUT VIBRATION

20% to 90% in <u>your</u> machines?



MACHINE vibration is usually caused by one or more of these five factors: bearings; motor; clutch; sheaves; v-belts. Frequently, v-belts alone are the major cause of vibration.

Actual performance on many different types of machine tools has proved that Veelos v-belts can reduce vibration 20% to 90%.

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Regular v-belts have spots of varying density due to their construction. These spots, though not apparent, throw the belt out of balance when the drive is operating. Vibration is created which not only can cause excessive wear on parts of the machine but which may also damage the finished work.

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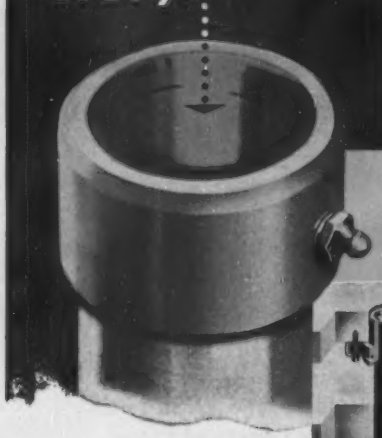

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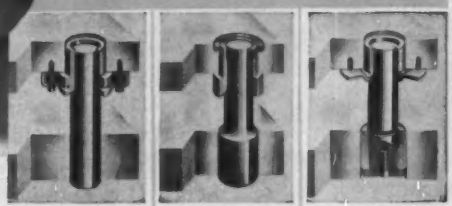

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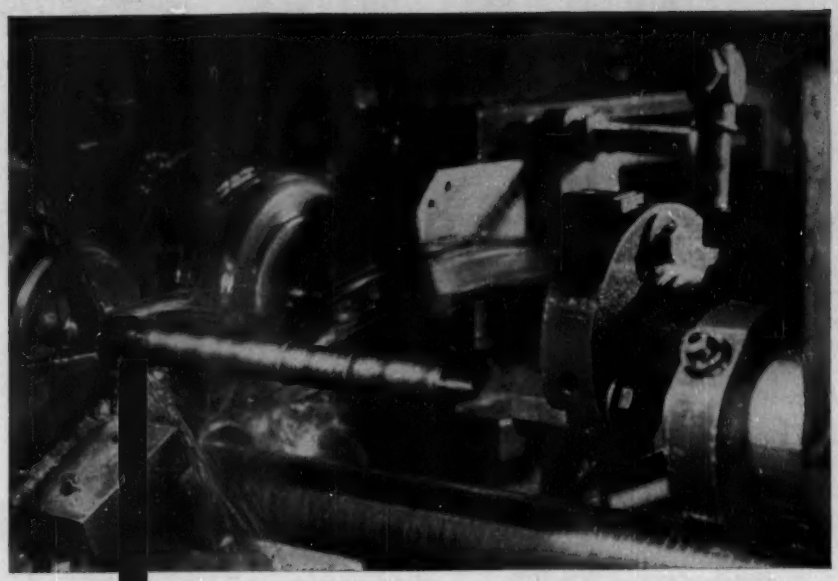

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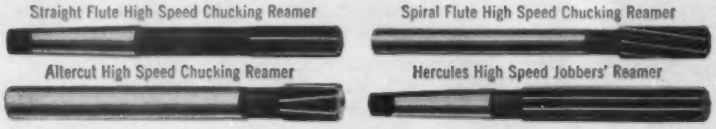
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Over 42 per cent of metalworking production equipment is now over ten years of age . . . 19 per cent of it was bought more than 20 years ago!

This means that there is more over-age and obsolete production equipment operating in metalworking shops now than in 1945, and the rate of obsolescence is growing.

How about your shop? Are you equipped adequately with the modern, high-efficiency machinery and equipment which alone can produce the better products that cost *less to buy* which everybody wants? How does your shop compare with those of your competitors, and with metalworking shops generally?

You can find out quickly by writing for a copy of the *American Machinist* Mid-Century Inventory of Metalworking Production Equipment. Here are all the facts on the age and number of 155 major types of production equipment, operating in 15 manufacturing divisions and 25 major production areas. Price: $2.00 per copy.

American Machinist

Reader Service Department

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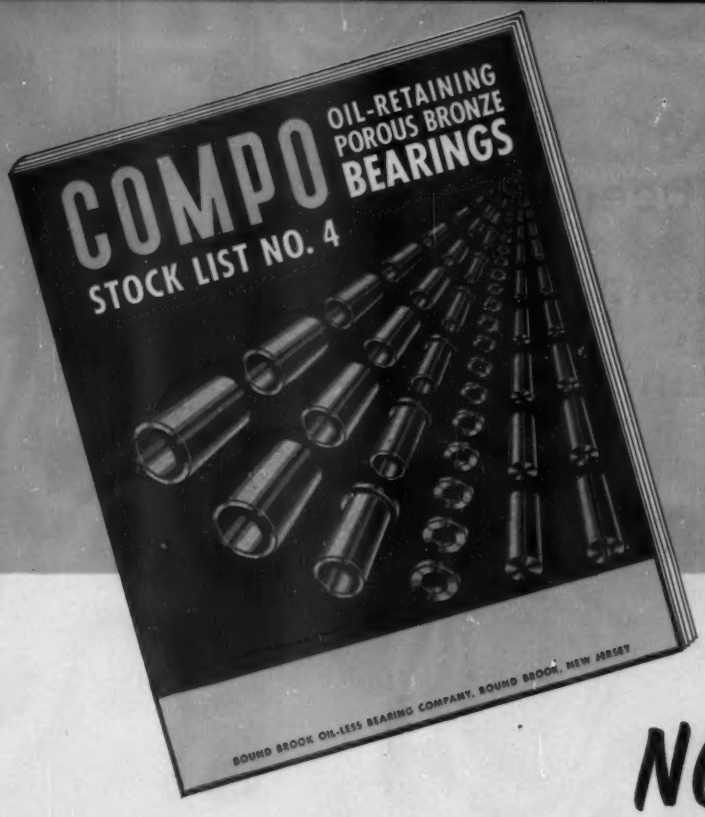
NEW YORK 36



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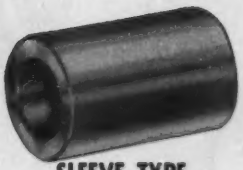

SLEEVE TYPE

FLANGE TYPE

BAR STOCK

CORED BAR STOCK

WASHERS

If you play a part in the design, production or maintenance of equipment using sintered bronze bearings, or if the job of purchasing bearings falls within your domain, you'll find a wealth of useful information within the 20 pages of the new Compo Oil-Retaining Porous Bronze Bearing Stock List No. 4. Bound Brook has compiled an easy-to-read list of the most popular stock sizes of bearings which are available for immediate shipment. In addition the Compo Stock List Brings you up-to-the-minute data on bearing application, installation, lubrication and machining. And here's another thought! When requesting your copy of the Compo Stock List why not have us send one to your supplier of bearing-using components or equipment? It may enable him to make savings beneficial to you both.

Write for a list of location of local warehouse stocks.

4

BOUND BROOK

BOUND BROOK OIL-LESS BEARING CO., EST. 1883, BOUND BROOK, N. J.

Pioneer in

POWDER METALLURGY BEARINGS & PARTS

We've been saying "Eye Accidents Cost More than $5.00"...*

Here's One that Cost $12,000

In compensation alone, the loss of sight of a worker's right eye cost one company $12,000 in a court award last year. Claimant had been sanding cars when his electric grinder broke and shattered the sanding disc.

This admittedly is a far more serious, far more costly eye accident than the average. It doesn't happen every day. It probably couldn't happen to one of your workers and you. Or could it?

One way to make sure is to install an AO Eye Protection Program. The average pair of AO safety glasses costs only $2.30 — even the average *slight* eye accident it protects against costs far more. Write American Optical Company, 4137 Vision Park, Southbridge, Mass. for booklet. Or ask an AO Safety Representative to call.

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AO SAFETY ZONE

Keep your workers in the Safety Zone with American Optical Safety Equipment

*Per employed worker per year

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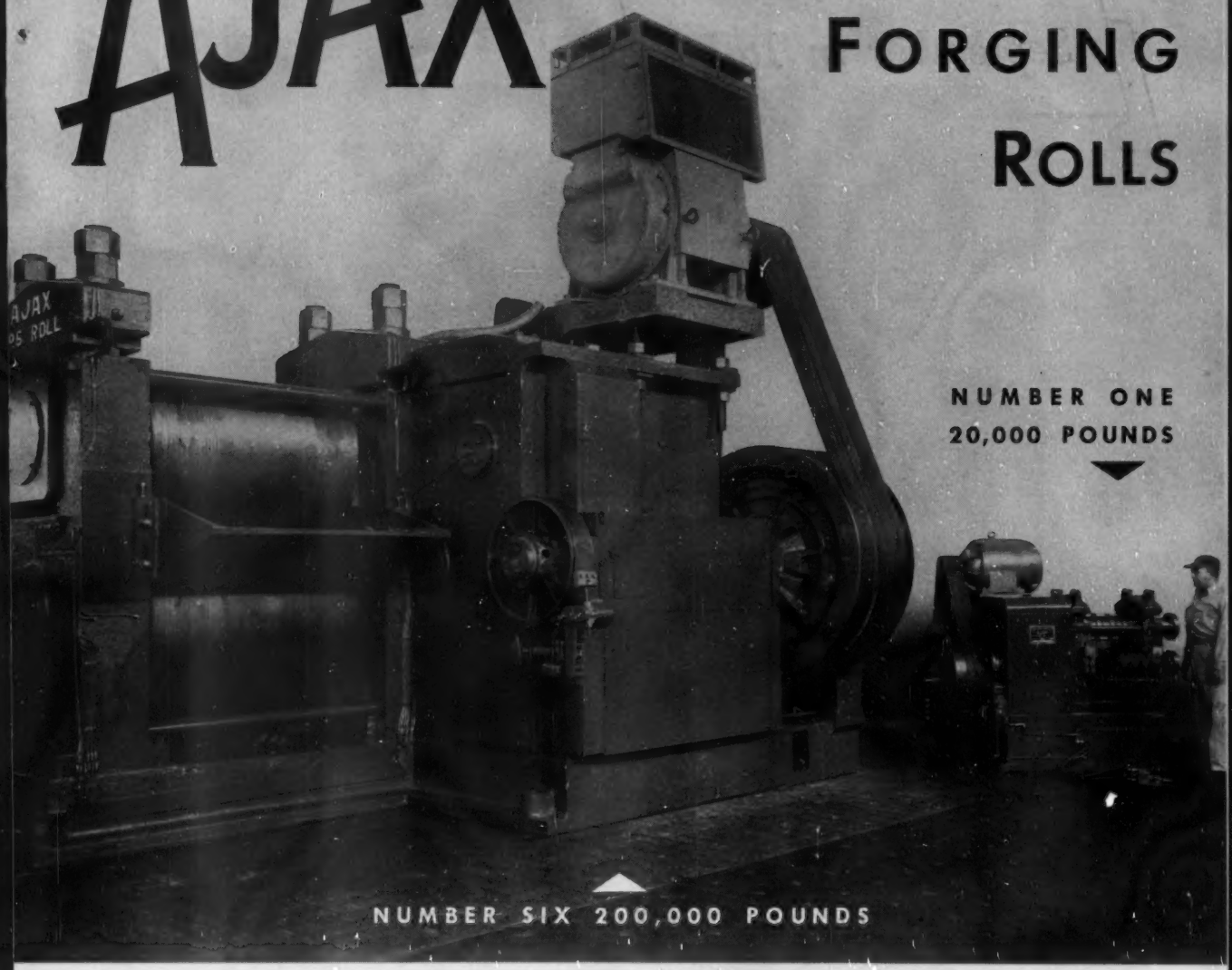
AJAX COMBINATION DIE FORGING ROLLS



NUMBER SIX specifically used for forging aircraft components. 200,000 pound AJAX FORGING ROLL shown at the left and foreground above is designed for pre-rolling blanks for subsequent DROP forgings.

NUMBER ONE universally used in aircraft, automotive, agricultural industries. 20,000 pound AJAX FORGING ROLL shown at the right above is designed for rolling reduced tapered and straight forgings and pre-rolling blanks for subsequent PRESS forgings.

BUILT IN SIX SIZES FROM NUMBER 0 TO NUMBER 6.
ILLUSTRATED AND DESCRIBED IN BULLETIN 91A.

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Punches 15" Holes For Warner & Swasey Gradalls

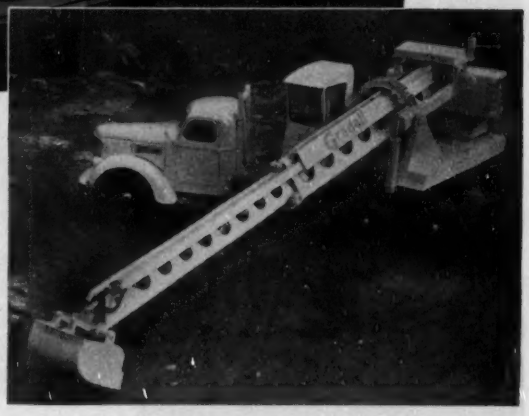
Also Performs Bending and Flanging Operations

Flanging 15" diameter holes in outer boom plates of 3/16" steel. The holes were punched previously on this press.

Practically all of the steel plate on Warner & Swasey Gradalls, manufactured at their New Philadelphia, Ohio plant, is formed, punched and flanged on a Steelweld Press which is designed to brake steel plate up to 16' x ½".

One of the more interesting jobs done on this machine is the punching of 15" diameter holes in Gradall boom plates, followed by a flanging operation. Through use of special movable punches, many smaller holes of various sizes are made at a time, in locations as desired.

The versatility of Steelweld Presses to handle efficiently many varied operations has proven of tremendous advantage to many users. You, too, may find the many features of these machines of great help. A representative will be glad to give you the details.



Gradall ready for action. Has ½ yd. bucket and 24 ft. telescoping boom that lifts, tilts, and turns 360° around truck.

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A variable speed feed for the feed rod is available as optional equipment. It provides an independent powered longitudinal or cross feed which permits the operator to change the rate of feed while the tool is under cut to secure the desired work finish during turning, facing or boring operations. The rate of feed for the variable speed feed is controlled by a potentiometer.

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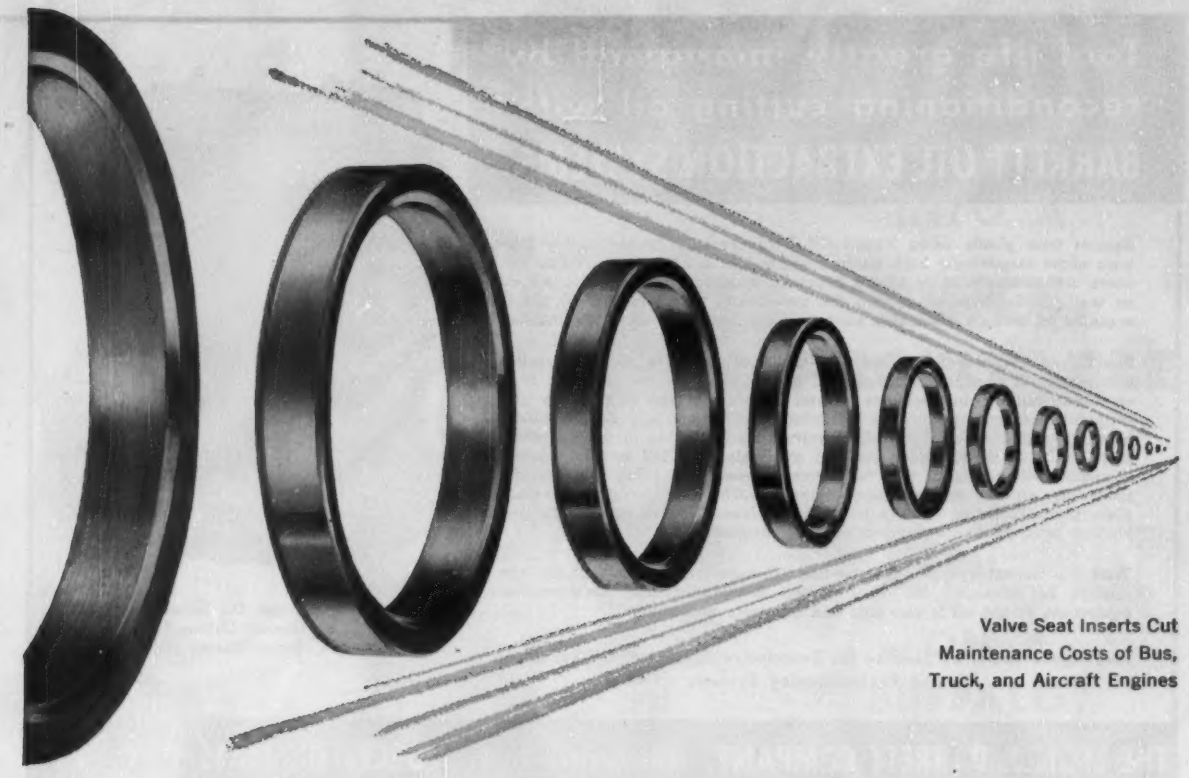

Valve Seat Inserts Cut Maintenance Costs of Bus, Truck, and Aircraft Engines

200,000 MILES BETWEEN GRINDS

Valve seat inserts made from HAYNES STELLITE alloy have given as much as 200,000 miles of service in truck engines before regrinding was required. These inserts stand up under continuous impact without cracking. They won't stretch or distort even under abnormal operating temperatures, and will retain their hardness even at high temperatures.

RESIST WEAR . . . CORROSION . . . OXIDATION

The wear, corrosion, and oxidation-resistant qualities of HAYNES STELLITE alloy valve seat inserts further insure peak performance at low maintenance costs. These cobalt-base parts resist the erosive effects of hot exhaust gases. They are practically unaffected by corrosives present in the fuel, and will not pound in at high operating temperatures.

AVAILABLE IN A VARIETY OF SIZES

The inserts can be supplied in a variety of sizes for use in bus, truck, aircraft, marine, and other types of internal combustion engines. The unusual properties of HAYNES STELLITE alloy make it possible to produce efficient inserts as thin as 5/32-in. in cross-section. Use of these thin inserts enables the engine designer to locate water jackets closer to actual valve seating surfaces, and provide a more effective cooling system.

For full information on sizes, and prices, write to Haynes Stellite Company, 725 South Lindsay Street, Kokomo, Indiana.

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Tool life greatly increased by reconditioning cutting oil *with*

BARRETT OIL EXTRACTION SYSTEMS

Reports from plants using Barrett Oil Recovery and Reconditioning Systems show surprisingly high percentages in increased tool life. Then, too, users are enthusiastic as to the improved condition of the reclaimed oil as well as the high returns on the investment. Some set-ups in plants engaged on defense production have paid for themselves in a few months.

The Barrett Centrifugal Oil Extractor—which is part of a complete system—recovers 100% of the removable oil or 98½% of the contained oil from chips and turnings in 2 minutes or less. Complete Barrett oil recovery and reconditioning systems include Extraction, Sterilization and Sedimentation, together with filtration. The units involved are available in various sizes, individually or as a group, and are available with full manual control, semi-automatic control or with full automatic control requiring only loading, unloading, starting and stopping of the extractor by the operator. Complete plans including storage tanks for reclaimed oil or for use in conjunction with existing equipment are also available.

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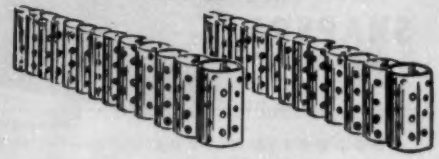
IT'S SO EASY TO TURN A "LONG GRIND" INTO A QUICK, PROFITABLE RUN —



— ON A "BUFFALO" NO. 16 DRILL LIKE THIS

"Fussy" jobs running into thousands of holes, such as the above, drilling graphite lubrication holes in bronze bushings, can be real headaches—but not with this "Buffalo" No. 16 Drill! See how controls, spindle and working table are designed from the operator's point of view. His position is always natural, relaxed. Visibility of work is always good. Accuracy and high output come easily on a "Buffalo" Drill! And this high-quality, medium-price, medium capacity drill is yours in a choice of 3 over-hangs, 8", 12" and 15"; sensitive (hand feed) or power feed in one to eight spindles, bench or pedestal models; in up to six spindles. Why not write for Bulletin 2730G and see the many jobs the "16" could be speeding up in *your* plant?

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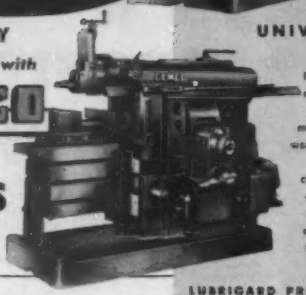

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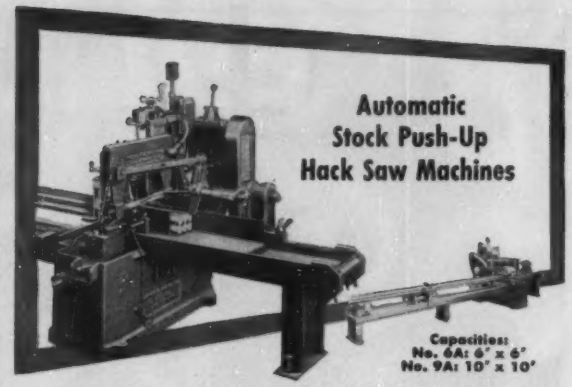

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Capacities:
No. 6A: 6" x 6"
No. 9A: 10" x 10"

Feed, Measure, Cut-Off—AUTOMATICALLY

These automatic stock push-up hack saw machines are not new. MARVEL built the first practical bar feed hack saw machines, over 30 years ago. The sound, proven, basic principle of these machines has never changed—but they have been constantly improved and refined. Today they are still the leaders—the most practical, fastest, most accurate, most productive cutting hack saw machines built. No matter what your cut-off work, let us recommend the MARVEL saw that will give you true economy, speed and accuracy at an attractive price.

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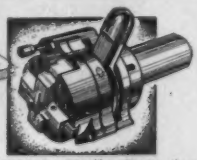
H&G Insert Chaser DIE HEADS



famous for accuracy and straightness of threads, low chaser costs, less downtime, more pieces per day.

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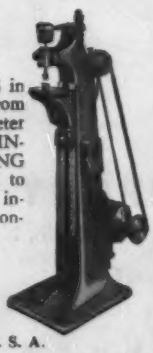

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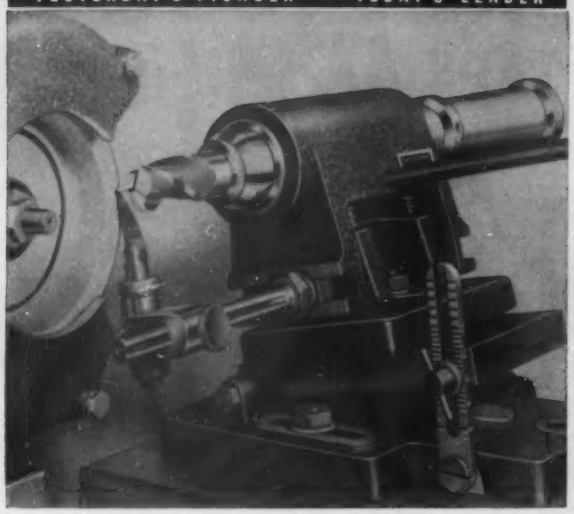

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This point is well taken by many manufacturers who fabricate Brass Rod into component parts for pens and pencils, clocks, lamps, electric and plumbing fixtures, screw machine parts, and what have you. And that's why so many of these manufacturers are what you might call "confirmed addicts" of Bristol Brass Rod.

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Try it out for yourself. Bristol Sales Engineering Service is airborne . . . at your service any time you say.

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In one 40-page booklet we have collected 154 detailed case-histories describing how difficult lubrication problems have been overcome by molybdenum sulfide. If you wish to be up to date about this solid-film lubricant, fill in the coupon below, attach it to your letterhead and send it off today.

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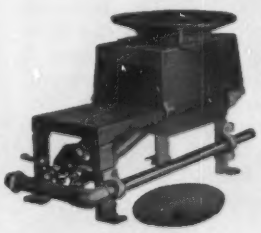

Here's speed, economy and lifetime service in this most efficient and economical soldering and general purpose bench furnace. This #22 furnace heats a pair of 12 lb. soldering coppers in 8 minutes. Can be used for melting lead, heating small tools, etc. Since 1911 BUZZER Soldering Furnaces have been the equipment of thousands of industrial plants, shops and schools.

Write today for catalog showing various types of furnaces, burners and other equipment.

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16 years . . .

. . . . . 20,000 Bridgeports

. . . a record of acceptance from 1938 to 1954

On August 8th, 1938, 16 years ago, the first BRIDGEPORT TURRET MILLING MACHINE left our old plant for the Precision Die Casting Co., at Syracuse, N. Y.

Judging from the number of milling machines produced up to that time, the Toolmaker and the Patternmaker shown here with the 20,000th machine were most optimistic when they had hopes they might be able to sell 5,000 of these machines before the market was saturated.

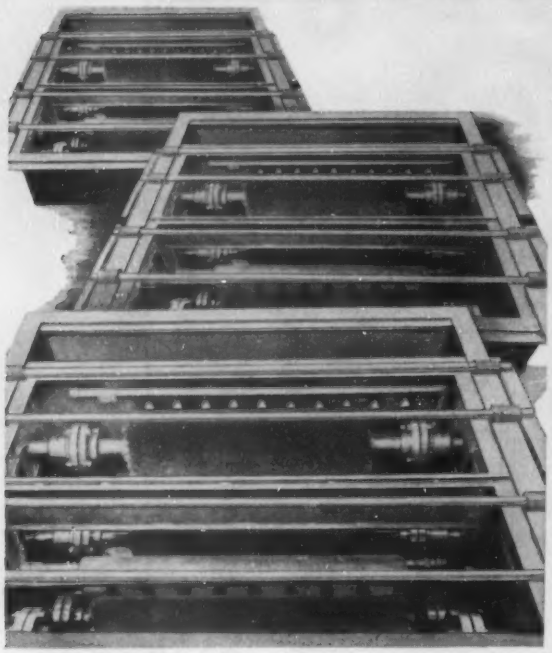
Either the judgement of these two men was very bad or the machine they had developed was awfully good, because the 20,000th machine left our new, modern plant on March 18th consigned to the Pioneer Electric & Research Corporation, Forest Park, Illinois . . . and every 45 minutes of a 50-hour week, another "Bridgeport" goes forward to an impatiently waiting customer.

Rest assured we shall always do our best to merit your continued confidence in the "Bridgeport" as expressed in its outstanding record of acceptance.

Bridgeport MACHINES, INC.

Bridgeport, Connecticut

Manufacturers of High Speed Milling Attachments and Turret Milling Machines



High quality finish and low maintenance costs are features of these Pittsburgh brushes used as original equipment by the W. S. Rockwell Co.

Want to Improve Original Equipment?

Here's the experience of one firm that did, the W. S. Rockwell Company, Fairfield, Conn., producers of a line of cleaning machines used on continuous strip annealing and pickling lines. A special problem existed in connection with these machines since the cold water rinse employed had a corrosive effect on most wire brushes.

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BRUSHES • PAINTS • GLASS • CHEMICALS • PLASTICS • FIBER GLASS

PITTSBURGH PLATE GLASS COMPANY

IN CANADA: CANADIAN PITTSBURGH INDUSTRIES LIMITED

M&M

GIANT KEYSEATERS

M & M Giant Keyseaters, built in a wide range of sizes, speedily and accurately cut internal keyways or splines in the bores of pulleys, gears, fly wheels or any other machine part. Special fixtures and cutters are available for unusual shaped keyways and taper work. Send us your problems today.

MITTS & MERRILL 68

104 Holden Street • SAGINAW, MICHIGAN

EDLUND

Sensitive Drilling and Tapping Machines for Economy and High Production

Capacities to 1½"

Write for latest Bulletins **EDLUND MACHINERY CO.**

Division Bradley-Edlund Corp.

Affiliated with Precision Castings Co. Inc. Cortland, New York

ACROMARK **ENGRAVES** DIES, STAMPS, PARTS, NAME-PLATES, SIGNS, HOBS, AND MAKES MEMORIAL TABLETS.

ASK ABOUT ACROCEL PORCELAIN ENAMELED PLANT SIGNS CARRIED IN STOCK

CAST BRONZE TABLETS & SIGNS

ACROMARK Company

7-13 MORRELL ST., ELIZABETH 4, N. J.

this RODGERS PLATEN PRESS

produces GRIDDLES at a sizzling rate!

Ever since they changed from a mechanical press to a Rodgers 100 ton Hydraulic Platen Press, Northland Aluminum Products of Minneapolis has reported they are not only pleased, but also surprised at the unusual results. No wonder! . . . production is up . . . product quality and finish is better . . . die wear is reduced . . . and die setup time is less. All these advantages are vitally important to Northland for they make a variety of products like Nordic Ware Aluminum Utensils, Griddle King Griddles and Steak Platters.

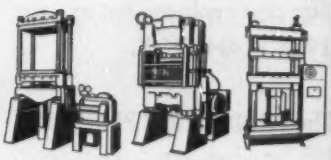
Although you may produce an entirely different line of products, you probably would find a Standard Rodgers Platen Press would offer you the same advantages . . . whether your jobs are stamping, forming, drawing, coining, or die try-out . . . in metal or plastics.

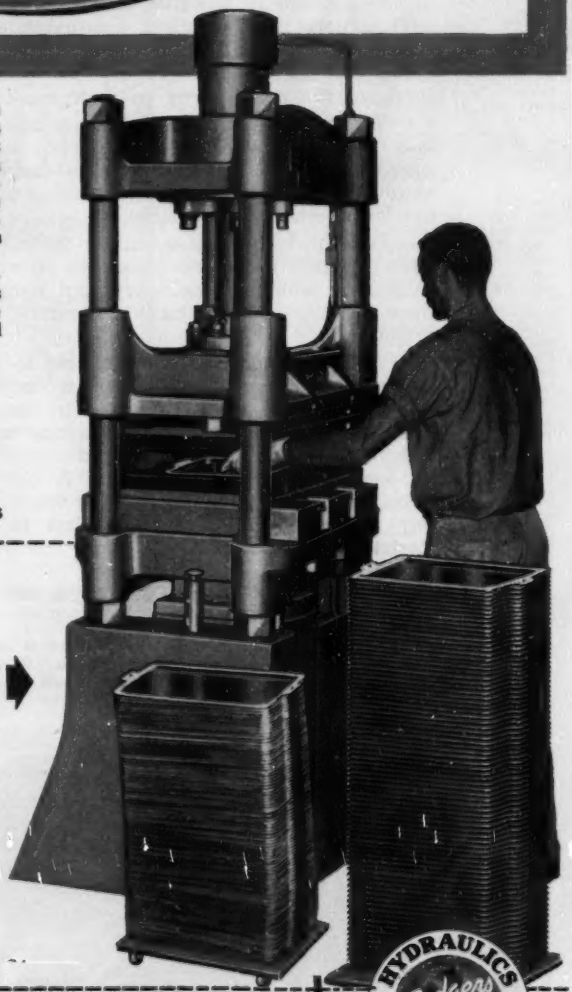
Write for the new Illustrated Rodgers Blue Ribbon Catalog

it gives complete details and specifications

RODGERS BLUE RIBBON PLATEN PRESSES FOR:

- **Metal Drawing and Forming**
- **Plastic and Rubber Molding**
- **Die Try-Out General Assembly and Utility Work**
- **Capacities from 10 to 500 tons pressure**



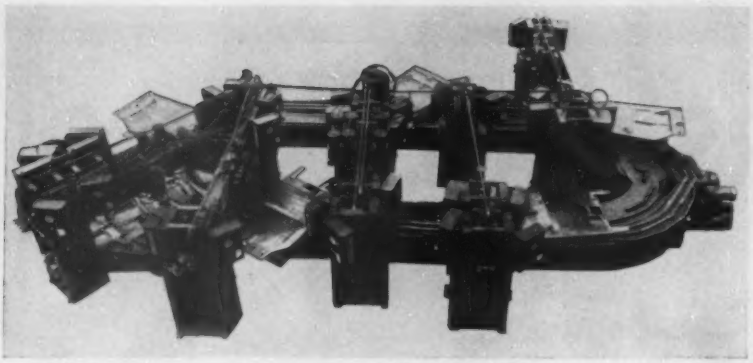


Here is the Rodgers 100 ton Hydraulic 24"x24" Platen Press which blanks and forms Northland Griddle Kings at the rate of 8 per minute. Aluminum is .153—finished size is 10¾"x17½"

Rodgers Hydraulic Inc.

7407 Walker St., Minneapolis 16, Minn.

HYDRAULICS Rodgers KEEPING THE WORLD MOVING



Early example of Federal Resistance Welding Automation is this Floor Pan Welder for a leading automobile builder. Placed into operation in 1938 it featured continuously moving fixtures and walking guns. Produced 250 units per hour.

Why All This Talk About Automation?

The automatic handling of work in process isn't a new idea. Leading manufacturers in almost every metal working field have been using "automated" machinery for years to increase the productivity of their work.

The talk about automation today, of course, is a result of the concentrated effort on the part of vast numbers of manufacturers, large and small, to stay competitive by trimming production costs whenever possible.

Federal, for almost a quarter century, has been working with such people in developing resistance welding machinery that would reduce costly, non-productive handling to a minimum.

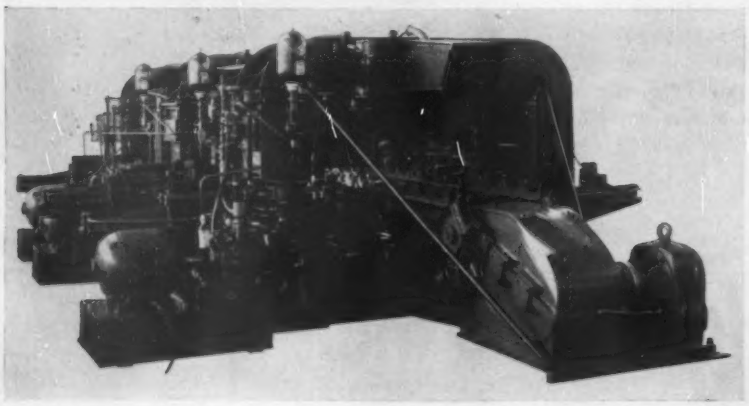
While automation may be new to many machine builders Federal design engineers have piled up 25 years experience in designing and building automatic handling and assembling equipment, dial, shuttle and transfer feeds for resistance welding. A big reason why you should take your welding problems to **"Federal — First in Resistance Welding."**

Federal® WELDERS

Warco® PRESSES

The Federal Machine and Welder Co., Warren, Ohio

Modern Example of Resistance Welding Automation is this Federal Special Three-Station Transfer Type Muffler Assembly and Welding Machine. It produces 600 complete assemblies per hour. Reduced labor forces required by several hundred per cent.



Man With A Bender Is Big Money Saver In Metalworking Shop

One man with a modern automatic bending machine now does the work formerly handled by six men and four presses in producing cam bars for a tractor rear wheel. And, tooling costs have been cut by 75%, scrap losses by 20%.

You will find hundreds of actual case histories . . . thousands of cost-cutting facts like these, in your 1954 PRODUCTION PLANBOOK for Metalworking, which you, as a subscriber to *American Machinist*, received in November. If you aren't already making good use of your new PLANBOOK, familiarize yourself with it now, and always keep it handy. It's worth plenty to you! There is no other single source for so much valuable, exclusive data on efficient modernization and replacement as your 1954 PLANBOOK.

The PRODUCTION PLANBOOK for Metalworking
is published every November by
American Machinist

CLASSIFIED SEARCHLIGHT SECTION ADVERTISING

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Propane Gas Installations
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Paul E. Peacock, Jr., Pres.
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MACHINE TOOL RECONDITIONING & the Art of Hand Scraping
— illustrated —
Write today for folder describing book
MACHINE TOOL PUBLICATIONS
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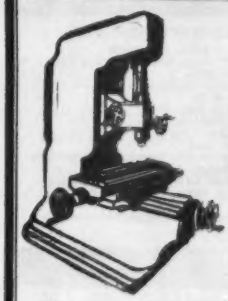

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This service is aimed at helping you, the reader of AMERICAN MACHINIST, locate used and surplus new metalworking machinery and equipment not currently advertised. (This service is for user-buyers only.)

First, read the dealer ads on the following pages. A 5-minute study may locate the equipment now.

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Searchlight Equipment Spotting Service
c/o American Machinist
330 W. 42nd St., N.Y. 36, N.Y.

Your requirements will be brought promptly to the attention of the used equipment dealers advertising in this issue. You will receive replies directly from them.

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7/5/54

REPLIES (Box No.):
Address to office nearest you
NEW YORK: 330 W. 42 St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITION VACANT

WANTED — MACHINE Shop Superintendent, age 40 to 50. Plant located northern Ohio. State experience and technical knowledge fully. Must be able to teach proper methods of operating machine tools as well as assembly work. P-3106, American Machinist.

EMPLOYMENT SERVICE

SALARIED POSITIONS $5,000 to $35,000. We offer the original personal employment service (established 44 years). Procedure of highest ethical standard is individualized to your personal requirements. Identity covered; present position protected. Ask for particulars. R. W. Bixby, Inc., 652 Brisbane Bldg., Buffalo 3, N. Y.

POSITION WANTED

MANUFACTURING ENGINEER — 18 years broad experience in Machine Tool design and uses, electromechanical products and special machinery. Plant layout, automation, methods, tooling and supervision. Can make your products better at less costs. Desire challenging permanent position. Write PW-3164, American Machinist.

CONTRACT WORK WANTED

Have open time for tools, dies, jigs, and fixture work. Multislide and four-slide, tools and dies our specialty. Send prints for quotation to: United Tool & Stamping Co., 10 Main Ave., Delawanna, N. J.

Old-Established firm, already making under license certain American Machines, open for similar arrangement with any firm desirous of having manufactured special machines which have an appeal, and need high-class workmanship. CWW-3051, American Machinist.

MANUFACTURER'S AGENTS

Old established cutting tool manufacturer desires experienced representatives in Chicago and Pittsburgh to sell milling cutters and special cutting tools on commission basis. Established agents having kindred but non-competing lines preferred.

RW-3012, AMERICAN MACHINIST
520 N. Michigan Ave., Chicago 11, Ill.

WANTED

MACHINERY WANTED

Bullard Mult-Au-Matic 12" with 8 Stations for Double Indexing. Should Be Built 1945 or Later. Give Serial #, Age, Condition and Price.

W-2908, AMERICAN MACHINIST
330 W. 42nd St., New York 36, N. Y.

GOOD USED MACHINE TOOLS

AUTOMATICS

6" 6 Spdl Bullard Mult-Au-Matic
14¾"x19" Fay (Flanders)
20"x23" Fay, timken, new 1942 (2)
28"x37" Fay, serials 80581 & 80557.

COMPRESSORS

275 CFM 10"x10" Union horizontal enclosed
311 CFM 12"x8" Ingersoll Rand air or gas
327 CFM 12"x7½"x12" Ingersoll Rand Imperial type
1400 CFM 21"x13"x10" Worthington Laidlaw horizontal

DRILLS—RADIAL

3½' arm 8" column American sensitive radial
4' arm 13" column Carlton M1B radial, late type
6' arm, 3' extension, 10" column American radials, late type (two)

GEAR HOBBERS

No. 3 & No. 12 Barber Colman
Type A Barber Colman universal
No. 12H Heavy Gould & Eberhardt universal
No. 36H Gould & Eberhardt
10" Cincinnati spur and spiral
6'-10" No. 1 Lees Bradner
No. 7S Lees Bradner
No. 3 Adams Farwell
72" S. & S. universal

GEAR MACHINERY MISC.

8" Red Ring Gear Shaver, two, late
8" Red Ring gear lapper
No. 60 Cross gear tooth rounder
Barnes "Mal" Nut O Lap gear lapper
National Cleveland gear checker
10" Pratt & Whitney hydraulic gear grinder
Nos. 71A, 78A, 712 and 715 Fellows high speed gear shapers
Illinois gear measuring machine
No. 343 Sheffield gear chamferer

GRINDERS

72" Hanchett rotary surface, new 1946
10"x36" Landis type DC, cyl. late, hydraulic
14"x36" Landis type C, cyl. hydraulic, late
16"x36" Norton type C, cyl. hydraulic, late
No. 2 Cincinnati centerless, plain and Filmatic bearing (Five)
10"x18" Cincinnati Filmatic bearing
10"x18", 10"x36" & 16"x72" Norton cylindrical
12"x36" Cincinnati universal cylindrical, serial 1U-3D-1D-5
16"/40"x96" Landis hydraulic cylindrical, gap type
No. 16A and 24-36 Bryant
No. 129A Gardner opposed spindle disc, 20"
23" No. 84 Gardner opposed spindle disc
52" No. 24A Gardner horizontal disc
30" No. 8 Badger double disc motor on spindle
No. 72AS Heald plain hydraulic internal
No. 72AS Heald Gagomatic internal
No. 72A3 Heald Sizematic internal
No. 5 Bryant internal
8"x18" Norton vert. spindle hydraulic surface
8"x22" No. 3 Abrasive surface
12"x48" Model 300 Hanchett surface new 1946
No. 3 Barber Colman hob sharpener
10" Pratt & Whitney hydraulic gear new 1944.

LATHES

24"x14' bed American GH, QCG, serial 44079
12" Sundstrand Stub lathes (three)
No. 3A Warner & Swasey long bed universal T/L, late
H5 Libby International saddle type universal T/L, Late
Leonard hydraulic tube spinning lathe, new 1947
14"x42" Headey CamLoc, timken, toolroom
14"x18" Lipe HS Carbo-lathe, new 1943
17"x8' LeBlond Mfg. timken, (three)
48"x52"x20'6" Niles-Bement-Pond engine lathe, like new

MILLING MACHINES

1-12 Cincinnati production miller
No. 3 Sundstrand Rigidmill production
12" Cincinnati plain manufacturing, also 18"
24"x24"x12' Ingersoll adjustable rail planer type mill mach., tracer controlled, new 1945
4—36 Cincinnati Hydromatic production
4—48 Cincinnati Hydromatic production
No. 2 Cincinnati high speed dial type plain
No. 1 Milwaukee vertical mill
No. 2B and 3K Milwaukee universal
No. 3B and 4K Kearney & Trecker plain

PRESSES

15 & 25 Ton Dennison hydraulic (4)
50 ton No. 304 Bliss, SS, solid frame, new 1942
50 Ton No. 25A Bliss OBI double crank, gap frame
60 ton No. 51 Cleveland, OBI (two)
88 ton No. 50-D-36 Cleveland, DC, steel frame
100 Ton No. 35P Toledo punching
128 ton No. 308 Bliss, SS, tiered frame
500 ton No. 1042 Verson, SS, all steel, air clutch, late model

SHAPERS

6" P&W vertical slotter
16" American Heavy pattern Auto-oiled
24" Cincinnati Climax heavy duty
32" G & E shaper
36" Morton draw cut shaper
36" Rockford vertical hyd slotter, 1942

MILES MACHINERY CO.
2039 East Genesee Ave.
Saginaw, Michigan Phone 2-3105

FINE LATE TYPE GUARANTEED TOOLS

16"x84" centers REED PRENTICE Model AA Toolroom Lathe, new 1944
28"x15' centers BERTRAM (Niles patterns) "Timesaver" Engine Lathe, 2 carriages, rapid traverse, AC-MD, new 1943
36"x12' centers AMERICAN Heavy Duty 16 Speed Geared Head Lathe, AC-MD
60"x20' NILES-BEMENT-POND Geared Head Engine Lathe, rapid traverse
No. 1L GISHOLT Saddle Type Universal Turret Lathe, presselector head, bar feed, chuck, new 1943
No. 2A WARNER & SWASEY Universal Turret Lathe, presselector head, bar feed, chuck, new 1943
No. 3A WARNER & SWASEY Turret Lathe, Timken spindle, electric chuck, tooling
No. 3 WARNER & SWASEY Universal Turret Lathe, 800,000 series
No. 4 GISHOLT Turret Lathe, Timken spindle, hardened ways
No. 2 VAN NORMAN Plain Horizontal Mill. New 1948
No. 3-24 CINCINNATI Plain Hydromatic Mill, AC-MD
No. 4 CINCINNATI High Speed Dial Type Plain Horizontal Mill, new 1942
No. 4 CINCINNATI High Power Dial Type Vertical Mill, 25 HP motor, new 1951
48"x48"x10' NILES Double Housing Planer, box table, DC reversing motor drive.
48"x48"x12' Cincinnati Double Housing Planer, power rapid traverse, DC reversing motor drive, box table, forced feed lubrication.
48" widened to 69"x12' DETRICK & HARVEY Double Housing Planer, box table, DC reversing motor drive
1½" LANDIS Bolt Threader, leadscrews, AC-MD
30" MORTON Hydraulic Keyseater, new 1942
No. 8A MITTS & MERRILL Keyseater, capacity 0 to 4" width, 36" stroke, tooling
4' HAMMOND Jackknife Radial Drill, tapping attachment, new 1948
5'-13" column CARLTON Radial Drill, AC motor & gearbox on base
6'-17" column CINCINNATI BICKFORD Super Service Radial Drill, power rapid traverse, motor on arm
36" BULLARD High Speed, fine feed attachment, Vertical Boring Mill, rapid traverse, new 1942
42" BULLARD Spiral Drive Vertical Turret Lathe, extra high column
42" KING Vertical Boring Mill, 10HP AC motor, power rapid traverse.
No. 5—55 Ton V & O, O.B.I. Press

O'CONNELL MACHINERY CO.
Tel: BAiley 5800
1695 GENESEE ST. BUFFALO 11, N.Y.

#1 M. & M. Saw Sharpener
#12 Van Norman Miller
DIVINE Buffing Lathes
#10 W.F.F. Thread Roller
BILLINGS & SPENCER Di-matic
#25A CLEEREMAN Drill
P & W Contour Cutter Grinders
Model J BRIDGEPORT Vert. Miller
#40 LEES BRADNER Thread Millers
#2 NORTON Tool & Cutter Grinder
#12 MARTIN Marking Machines
#72 ETNA Swager
Numerous Other Machine Tools
CURRIER MACHINE SALES
376 State St., Box 292
North Haven, Connecticut
MDNA

MACHINERY FOR SALE

Brown and Sharpe Hobber, No. 44, serial No. 104 with Crocker Wheeler Motor, serial No. 748275. Equipped to cut spur and spiral gears and splines.

Schuchardt and Schutte Hobber, 36" CAP TP #2, serial No. 6706. Equipped with differential for cutting spur, spiral, and worm gears.

60" Reinecker Hobber, RF No. 4N, Serial No. 6937/1. Completely rebuilt. Equipped with Tangential feed and differential.

These hobbers now being used in production and in excellent condition. Can be seen in operation.

All of the above equipment motorized, 220 volts AC, 3 phase.

FS-8480, AMERICAN MACHINIST
330 W. 42 St., New York 36, N. Y.

BENNETT MACHINERY CO.

GUARANTEED MACHINE TOOLS

AUTOMATICS, 1⅞" 8 Spin. Conomatic
BORING MILLS, 42" King, Side Hd., New 1942
42" Bullard, Spiral Drive
54" Bullard, New Era, Excellent
72" King, P.R.T., M.D.
100" & 72" N.B.P., 2 hds., M.D.
3¾" bar Defiance, Table (2)
4½" bar Sellers Floor Type
5" Bar Niles, Floor type
RADIAL DRILLS, 5'15" cst. Amer., Motor-on-Arm
GRINDER, 16"x30" Landis Hyd., Late
GEAR SHAPERS, Nos. 645A3, 61A & 61 Fellows
LATHES, 50"x30" Bed Niles, Late, Wet Hd.
14"x60" cen. Amer. T.A.
SLOTTERS, 20"-24" & 12" DIH-Labdelis
36" Rockford Hyd. 1942

375 Allwood Rd., Clifton, New Jersey
Phone: PRescott 9-8996 N. Y. Phone: LOngacre 3-1222

HOBBING PRESSES
REASONABLY PRICED

Capacity 3000 Tons—Platen Area 40"—Movable Top Head, Adjustable from 24" min. to 48" max.—Approx $5000 worth of Tooling.

• • •

Capacity 1000 Tons—Self Contained—Complete with Safety Guard and maximum Pressure Regulator.

M & N HYDRAULIC PRESS CO.
780 ROUTE 3, CLIFTON, N. J.

Hardinge Model H.C.T. Chucker, 1944.
Fellows Straight Line Generator.
Gleason 3" Spiral & Str. Gear Generator.
No. 3A B & S Universal Mill, Ser. 1806.

D. E. DONY MACHINERY CO.
4357 St. Paul Blvd., Rochester 17, N. Y.

MACHINERY FOR SALE
ATTENTION EXPORTERS

Unusual opportunity to procure modern Fellows Gear Shapers 615A and 645 as well as 12" Gleason Generators, 36 BM Gould & Eberhardt Rougher, #7 Fellows Gear Shaper, #16 D. E. Whiton Machine. Write for full information.

FS-1633, AMERICAN MACHINIST
330 W. 42 St., New York 36, N. Y.

FOR SALE

1—Heald Sizematic, completely rebuilt by the Heald Machine Company within the last 6 months, serial No. 6887.

FS-8821, AMERICAN MACHINIST
330 W. 42nd St., New York 36, N. Y.

BUY FROM STOCK
Telephone
BAKER 5887

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MACHINERY COMPANY

10 WARD ST.
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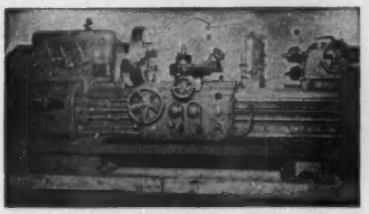
Every Item Guaranteed as Represented



24"x10' AXELSON GEARED HEAD, HEAVY DUTY MODEL "E" 28" ACTUAL SWING, M.D. TAPER ATTACHMENT.

LATHES

20"/27¾"x14' AXELSON Lathe, 115" centers, Taper Attachment, Late.

24"x12' BOYE & EMMES Timken Bearing, Geared Head, Lathe. Late Type.

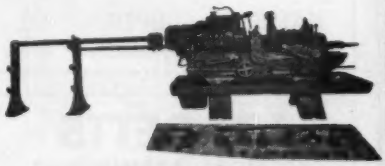
27"x16' NILES, BEMENT, & POND Geared Head Lathe, 9' centers, M.D.

24", 36" BULLARD Vertical Turret Lathe, New Era, Turret Head, Side Head, Motor Driven.

No. 601 W.D. OSTER Motor Driven Turret Lathe, 1½" capacity, Late.

No. 2, No. 5 WARNER & SWASEY Geared Head Turret Lathes, Bar Feed, Motor Driven.

16"x54" centers AMERICAN Pacemaker Lathe, Taper Attachment, Late Model.



No. 7 BARDONS & OLIVER Universal Turret Lathe. 2½" capacity. Preselector Head, Late Type.

No. 00G BROWN & SHARPE High Speed Automatic Screw Machine, Motor Driven, Late type.

No. 1 LaPOINTE Motor Driven Horizontal Broach, 5 tons cap., 38" stroke.

50 HP. CHICAGO PNEUMATIC Air Compressor. Type NSB, 253 CFM, Piston Displacement.

MILLING MACHINES

#2 KEMPSMITH Horiz. Maxi-Mill, Motor in base, Vert. Head.

#08 CINCINNATI Vert. Mill, Plain & Rotary Table Type.

#3B KEARNEY & TRECKER Vertical Milling Machine, Motor in base.

No. 0-8 CINCINNATI Rise & Fall Horiz. Mill, Late Model.

No. 3B KEARNEY & TRECKER Horiz. Mill, Double Overarm, Motor in base.

No. 2M CINCINNATI Universal Horizontal Mill, Full Equipment, M.D.

96" x 86" x 28' NEWTON PLANER TYPE MILLING MACHINE. 2 Heads on Rail; 2 Side Heads; Pendant Control; Late Type; Inspect under power.

DRILLING MACHINES

4'x15" Column CINCINNATI-BICKFORD "Super-Service" Radial Drill, Motor on arm, Box table.

4' x 15" CARLTON Radial Drill, Motor on arm, 48 spindle speeds, 1943, Late Type.

No. 262 BARNES Motor Driven Sliding Head Drill Press. 2" cap. in steel.

No. 2 M.T. Six Spindle ALLEN Type KH Drill Press, Individual Motor Drive, Late Type.

#M200 DEFIANCE Production Drilling Machine. 2" Cap. in Steel.
#5 M.T., Coolant System. Late Type. 26" Swing, 1942.

No. 5 FEDERAL Open Back Inclinable 4" stroke, Timken Bearing Flywheel, M.D.

600 ton NILES-BEMENT-POND Motor Driven Wheel Press, 86" between strain rods, 14' cap., 17" diam. ram.

#5, #7, #8 JOHNSON O.B.I. Presses. 56, 79, 90 tons cap. M.D. Flywheel & Geared Type.

10"x10" RACINE #30-C Hydraulic Heavy Duty Shear Cut Power Hack Saw, 1946.

10'x10 ga., 10'x¼" WYSONG & MILES Power Squaring Shears, Motor Driven.

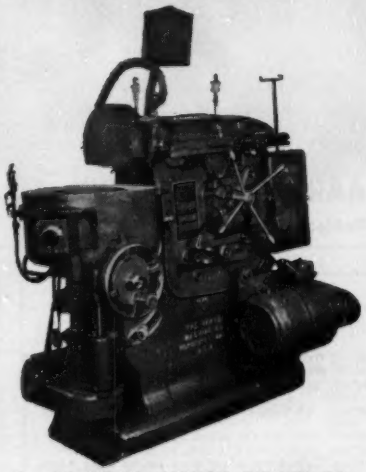
GRINDERS

6"x18" LANDIS Type "C" M.D. Hydraulic Cylindrical Grinder, Serial #29196.

6"x18" NORTON Vertical Hydraulic Surface Grinder, complete with magnetic chucks, coolant systems, Late Model.

#TG615 JONES & LAMSON Thread Grinder, Late, M.D. and TG848.

No. 208 BESLEY Motor Driven Disc Grinder, 26" wheels, Late Type.



No. 22 HEALD MOTOR DRIVEN ROTARY SURFACE GRINDER. 12" Magnetic Chuck. Late Model.

20", 24", 28" GOULD & EBERHARDT V-Ram Shapers, M.D.

No. 194 BARNES Vertical Hone, 4" capacity, 12" stroke, Motor Driven.

30 K.W. LEPEL High Frequency Induction Heater.

No. 8LS FELLOWS M.D. Gear Lapping Machine. With Detachable Head, Universal Work Support.

No. 20, WATERBURY FARREL Thread Roller, ⅜" cap., 1944.

#0, 1½ BUFFALO FORGE Universal Ironworker, Notcher, M.D.

15' x 10' x 36' BETTS PLANER, DOUBLE HOUSING, BOX TABLE, 2 Swivel Heads on Rail; 2 Swivel Side Heads; Pendant Control Variable Speed Main Drive Motor, 75 HP. Inspect under power.

OVER 1000 MACHINE TOOLS AVAILABLE IN STOCK • SEND US YOUR INQUIRIES

TREMENDOUS MACHINES AT TREMENDOUS SAVINGS

LAKE ERIE PRESS 2500 TON

36" Downstroke; 42" Daylight.
Bot. Platen 120" L. to R. 96" F. to R.
Between columns 58" L. to R. 60" F. to R.
100 H.P. 3/60/440 V. motor. Push button controlled.

HORIZONTAL BORING MACHINE OHIO 5"

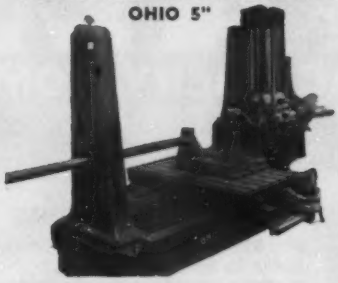


Table 48" x 84"; bed length 10'. AC motor. Speeds: 3.3 to 198 RPM; vertical travel 60"; rapid traverse; facing attachment.

DEFIANCE

Hoz. Bor. Mill 3¾" Table 60x30
Speeds 5 to 1200 R.P.M. New 1940

UNIVERSAL

Hoz. Bor. Mill 3" Table 58x32"
42" Vert. Travel. Table to Spindle
72" Speed 16 to 650.

JONES 60" VERTICAL SHAPER

Table—72" diameter. Will move a distance of 36" either to the left or right of tool. Bed Length 154".

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No. 45 HEALD Boromatic, Single End, Two Spindle
12x30" MONARCH Geared Head Lathes
30"x10' bed AMERICAN High Duty Geared Head Lathe
36"x17" AMERICAN Heavy Duty Geared Head Lathe, 1941
42"x15' AMERICAN Heavy Duty Lathe
42"x25' centers AMERICAN Heavy Duty Lathe
60"x10' LeBLOND Heavy Duty Geared Head Lathe New 1952.
Nos. 5A and 5Y BRYANT Internal Grinders
No. 18 BLANCHARD Vertical Rotary Surface Grinder
10x36 HILL CLARKE Plain Cylindrical Grinder
No. 172 HEALD Gap Internal Grinding Machine for large swing
10"x72" LANDIS Type C Hydraulic Plain Grinder —1942
24"x276" LANDIS Type B Hydraulic Pl. Grinder
42" BULLARD "Spiral Drive" Vert. Turret Lathe.
Nos. 4D and 6S POTTER & JOHNSTON Automatic Lathes.
IL GISHOLT Universal Turret Lathe, 1946.
No. 8A JONES & LAMSON Saddle Type Universal Heavy Duty Turret Lathes.
No. 2 CINCINNATI HS Dial Type Plain Millers.
No. 8-8 CINCINNATI Plain Milling Machines.
No. 2M CINCINNATI Vertical Miller, 1941.
FITCHBURG Plain Horizontal Mfg. Type Milling Machine, 24"x72" table.
No. 1-18 CINCINNATI Plain Mfg. Miller.
No. 3B BROWN & SHARPE Dual Control Plain Miller
No. 5 CINCINNATI High Power Plain Miller with motorized overarm
E-5 & 2AL NATCO Multiple Spindle Drilling Machine
Nos. 64 and 72 FELLOWS High Speed Gear Shapers
No. 12 FELLOWS Gear Shaver, 1943.
No. 36BM GOULD & EBERHARDT Gear Roughr
16/20" GOULD & EBERHARDT Industrial Shaper
36" OHIO "DREADNAUGHT" H.D. Shaper
100" BETTS Vertical Boring Mill, 2 heads.
CINCINNATI BICKFORD Precision Drilling Machine with Bullard Man-au-Trol Table.

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Cincinnati #2 Universal Medium Speed, Dial Type Milling Machine with Motor Driven Overarm Universal Milling Attachment $4950.00

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WILLIAMS PIPE THREADER 3" to 12" factory gear box drive with cutters.

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Model 5Y Bryant, m.d.
No. 16—16" Bryant, m.d., Hydraulic Hole Grinder
No. 16CR16 Bryant, m.d., latest
No. 16—22" Bryant, m.d., latest
No. 16—38" Bryant, m.d., latest
No. 24P—36" Bryant, m.d.
No. 24—21" Bryant, m.d.
No. 44 Heald Facing Type Borematic, m.d.
No. 70A Heald, m.d., latest
No. 72 Heald Sizematic, m.d.
No. 72A Heald Sizematic "Duplex", m.d.
No. 72A Heald Gagematic, m.d.
No. 72A3 Heald Internal, m.d.
No. 72A3 Heald Sizematic, m.d.
No. 72A3 Heald Gagematic, m.d.
No. 72A5 Heald Sizematic, m.d.
No. 72A5 Heald Plain, m.d.
No. 73 Heald Airplane, m.d., latest, new
No. 74 Heald, m.d.
No. 81 Heald Gagematic, Sizematic, m.d.
No. 81 Heald Plain & Sizematic, m.d.
No. 640—16" Van Norman Automatic Oscillating Radius, m.d., latest
No. 5 Bryant, m.d., latest

TOOL & CUTTER GRINDERS

#1 LeBlond Universal Tool & Cutter, m.d.
Gisholt Universal Tool Grinder, belt
Type 05D Sellers Drill Grinder, m.d.
No. 0-2 GP Sellers Drill Point Thinning Machine, m.d.
Grand Rapids Tap Grinder, style 12M
Gleason Cutter, belt drive
No. 2A Wm. Sellers Universal Tool Grinder, m.d.
No. 2B Sellers Wet Grinder, m.d.
No. 2 Lumsden Oscillating Tool Grinder, belted m.d.
No. 4T Sellers Tool, m.d., latest
No. 5T Sellers Tool, m.d.
No. 13 Gleason Cutter Sharpener, m.d., late
Pratt & Whitney Deep Hole Drill Sharpener, m.d., latest
Gould & Eberhardt Gear Cutter Grinder, 2 step cone pulley belt drive
Oliver Ace Universal Tool & Cutter Grinder, m.d.

MANUFACTURING LATHES

12x18" Reid Small Piece Production Lathe, Model 6WSL, m.d.
No. 3 Lodge & Shipley Duomatic, m.d., late type
No. 3A Lodge & Shipley Duomatic, m.d., late type
No. 3 Niles-Bement-Pond Axle Lathe, m.d.
Model B1 Blount Speed Lathe, m.d.
W. C. Lipe Carbo Semi-Automatic, m.d., late
W. C. Lipe Carbomatic, m.d.
Ceborne Mfg. Bench Type Speed Lathe, m.d.
No. 4 LeBond Boring Lathe, 37' bed, 4" hole, m.d., latest
No. 9, 12 LeBlond Multi-Cut, m.d.
4x60" LoSwing, m.d.
8x108" LoSwing, m.d., taper, latest
8x132" LoSwing, m.d., latest
9x12" Sundstrand, s.p.d.

PLAIN CYLINDRICAL GRINDERS

6x15" Cincinnati Plain Hydraulic, m.d.
6x18" Cincinnati Model EA, m.d.
6x18" Cincinnati Model ER Plain Hydraulic, m.d., Filmatic Spindle
6x18" Landis Type C Hydraulic, m.d., late
6x30" Cincinnati Hydraulic, m.d.
10x18" Cincinnati Model EA, m.d.
10x36" Cincinnati Hydraulic, m.d.
10x72" Landis, m.d.
10x72" Norton, motorized
12x36" Landis, m.d.
12x96" Landis, Plain Self-Contained, m.d.
14x18" Cincinnati Plain Self-Contained, m.d.
14x48" Cincinnati Plain Self-Contained, m.d.
14x52" Norton, motorized
16x72" Landis Plain, m.d.
16x120" Norton Type C, m.d., late
16" raised to 26"x72" Type C Norton, m.d.
No. 20—10x18" Brown & Sharpe, m.d.
20x120" Landis Plain Self-Contained, m.d.

UNIVERSAL CYLINDRICAL GRINDERS

No. 3 Brown & Sharpe Universal Grinder, m.d.
6x20" Fitchburg Hydraulic Spline & Gear Grinder, m.d., latest
12x48" Norton Universal, m.d., latest

CYLINDER GRINDERS

No. 50 Heald Hydraulic, m.d., 11-18" spindles
No. 73 Heald Airplane Cylinder Grinders, new, m.d.
Model FG Micro Cylinder Grinder, m.d.
No. 78 Heald Centerless Cylinder Grinder, m.d.

SURFACE GRINDERS

No. 2B Brown & Sharpe, m.d.
No. 121 Hanchett Production Face Grinder, type BD, m.d.
No. 22—12" Heald Rotary, m.d.
No. 33 Abrasive Vertical, m.d.
No. 260—16" Heald Rotary, belt
14" Pratt & Whitney Vertical, m.d.

HONING MACHINES

No. 854 Micro-Matic Vertical Honing Machine, m.d.
H1 Micromatic Horizontal Hydrohoner, m.d.
H4 Micromatic Horizontal Hydrahoner, m.d.
No. 6 Barnes Twin Spindle
Model #182 Barnes Drill Hone, m.d., latest
Model 306H Barnes, single spindle.

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OLIVER: 10" Template Tool Bit

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ALLEN: No. 2 Drill—6 Spindle, 8" overhang
ALLEN: #2½ High Speed 15"
BARNES: No. 210, 2-spindle, 21" Swing
PRATT & WHITNEY: ½B x 50 Deep Hole Drilling & Reaming Machine, 2-spindle
RADIAL DRILLS: Archdale, 5', 6' & 7', new

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FELLOWS: 61A & 64A Shaper, 18" dia.
FELLOWS: Flat Top Helical Gear Cutter Grinder
FELLOWS: Straight Line Generator, 3" dia. with many cutters
GLEASON: #12 Rough & Finish Gen.
SYKES: Rack Cutting Machine 12" to 36" length capacity (New)
INTERNAL GEAR GRINDER, GG-31

GEAR TESTERS
FELLOWS: 8 LSI and 13 LSI Gear Lappers, external and internal spur and helical
FELLOWS: #12C Cone & Spacing Inspection Instrument
GLEASON: No. 3 Bevel Gear Tester
GLEASON No. 4 and No. 6 Bevel Gear Testers. Hand and Power
NATIONAL BROACH: SIC-12" Red Ring Gear Testing Machine

GEAR HOBBERS
CLEVELAND: #130 & 140 Rigidhobbers
REINECKER 60"
BROWN & SHARPE No. 44 20" cap.
SCHUCHARDT & SCHUTTE, 36" cap.
LEES BRADNER 49A

GRINDERS—CYLINDRICAL
BROWN & SHARPE: No. 10 cap. 6"x18" plain
CINCINNATI: 6"x18" Hydraulic, Plain
LANDIS: 16x32" Type "D" Crankpin, hydraulic, for grinding crankshafts
NORTON: 12"x18" Type C, Universal
NORTON: 10"x36", 30 Deg. Angle Wheel
NORTON: 10"x18" 45° angle wheel

GRINDERS—GEAR & SPLINE
GEAR GRIND MACH.: GG-19, 10"x24" Hydr. Spur Gears and Splines
GLEASON: #17, 23½" P.D.
PRATT & WHITNEY: 10" single and double
INTERNAL GEAR GRINDER, GG-31 wheel, hydraulic feed

GRINDERS—INTERNAL
BRYANT: Nos. 5, 5Y, 16-16, 16-CP-16, 16-28, 24-L-36
HEALD: #50 Planetary
HEALD: #72A3 Sizematic
HEALD: #72A3 & #72A5

GRINDERS—RADIUS
VAN NORMAN: #73, capacity 7½"
VAN NORMAN: #649-16, cap. 6" to 16" dia.
VAN NORMAN: #3½" Un. Radius

HONING MACHINES
BARNES: Model 224, 4" dia. x 16" stroke
BARNES: Model 172, 7" stroke.
MICROMATIC: H-510 Double End Horizontal, ⅝" to 2" dia.
MICROMATIC: H-2 Single End Horizontal, 2 spindle, ¼" to 1" dia.

LAPPING MACHINES
FELLOWS: 8 LSI and 13 LSI Gear Lappers, external and internal spur and helical

LATHES—PRODUCTION
BLOUNT: Polishing speed lathe 12" dia. x 48" centers
LODGE & SHIPLEY: #3A Duomatic, 25½" swing x 27" centers
POTTER — JOHNSTON: #4D Auto Turret

LATHES—TURRET
BULLARD: 36" Vertical turret
WARNER & SWASEY: #1A, #2A, #3, #3A, #4, #4A & #5
HERBERT. #0, #2, #4, #7, #8 and #9B/30 Sizes, new

LATHES—TURRET—continued
WEBSTER & BENNETT: Vert. 36" & 48" (New)

MILLING MACHINES
TAYLOR-FENN: M-80 Duplex Spline
RICE-BARTON: 4" Twin Spline
VAN NORMAN: 10CT Contour Miller, horizontal opposed spindle type for milling flat cams, also can be converted to similar work

SAWS & CUT-OFF MACHINES
RUSSELL: 9½" cut-off Saw with Auto. Stock Feed (New) Hydraulic
RUSSELL: 5½" dia. cut-off saws, auto stock feed, hydraulic (New)
MOTCH & MERRYWEATHER: No. 3 Circular Saw with auto. stock feed
MARVEL: No. 6 Hacksaw, 6"x6"

THREAD MILLERS & TAPPERS
HALL PLANETARY: Mod "D" Thread Miller
LANDIS: 2½" single head horiz. threading machine
LEES-BRADNER: #40A Thread Miller
LEES-BRADNER: CT-36 Thread Miller chucking type, 13½" hole
MURCHEY: #22 Horizontal threading and tapping machine, ½" to ½" dia. capacity.
NATCO: 16 spindle Tapper ⅜" cap.

MISCELLANEOUS
GARDNER: Model 84A Double Disc Grinder, 23" Wheel
MOLDING MACHINES, ROLLER JOLT: Osborne Model 2047-3
AUTOMATIC SCREW MACHINE, Wickman Single Spindle, 7/16" New
RACK CUTTING MACHINE: Sykes 12" to 36" length capacity (New).
CUT-OFF: Russell 5½" & 9½" cut-off saws with auto. stock feed (new) hydraulic
TEST STAND: Denison 918-AM Hyd.
HARDNESS TESTER: Grogan Brinell, 16-8
SHEFFIELD: Precisionaire Gauge
SUNDSTRAND: Double-End, #53, 42" & 60" Centering Mach.
WIRE FORMING MACHINES: 4-slides (new)

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48" Jungenthal Vertical Turret Lathe. New.
650 Ton Verson Double Action Eccentric Press. 1940.
HP-100 LaPointe Horizontal Hydraulic Broach. 1945.
3'-9" Cincinnati Bickford Radial Drill, 1943.
12" Gleason Gear Generator. 1942.
No. 7 Gleason "Revex" Gear Rougher. 1943.
24D Hanchett Duplex Rotary Surface Grinder 1945.
16"x72" Norton Univ. Grinder. 1942.
17"x42" Norton Crank-o-Matic, 1943.
645 Fellows Gear Shaper 1942
TG615 Jones & Lamson Precision.
No. 35 Excello Precision Thread Grinder.
20"x33" Fay Automatic Lathe 1942.
24-36 Bryant Hydraulic Internal Grinder. 1942.
No. 72A3 Heald Plain Hydraulic Internal Grinder. 1941.
#2 Cincinnati Centerless Grinder 1943
No. 6DRE Potter & Johnston Automatic. Late.
No. H5 Libby Universal Saddle Type Turret Lathe. 1939.
No. 3R Gisholt Universal Saddle Type Turret Lathe. 1942.
No. M-18 Kearney & Trecker Simplex Mill 1943.

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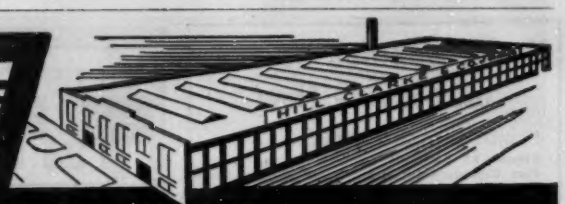

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Partial List

Automatics

1-1/16" Cleveland Model A (1942).

Boring Machines

No. DB2112 Excello Single End Borer.
100" Niles-B-Pond Vert. Bor. Mill.

Drills

No. 2 Avey Cam Fd. Drill. 14" Swing.
2 Spdl.—24" SW.—No. 3 Avey.
No. 57H Fox 24 Spindle Multiple Drill (1943).
No. K60H Fox 16 Spdl. Multi Drill
No. 2-20" 2 Spdl. Leland-Gifford LMS Drill
No. LBM-20" 3 Spdl. Leland-Gifford Drill.

Gear Machines

11" Gleason Gear Generator.
No. 12HS Gould & Eberhardt.
No. 36-BM G. & E.—3 spdl. Rougher.
615-A Fellows Gear Shaper.
612-A Fellows Gear Shaper.

Grinders

6"x18" Norton Type C Plain (1943).
10"x18" Norton Type C Plain Hyd. Cam Gdr.
10"x36" Norton Type C Grinder.
10"x36" Norton Type C Cam Grinder.
No. 4 Cinn. Pl. Hi-Speed Dial Type (1944).
B-24—25" Chuck Arter Surf. Gdr.
TG615 J & L Thread Gdr.

Internal Grinders

No. 1109 Bryant Internal Gdr. (1951).
No. 5 Bryant Internal Grinder.
No. 5B Bryant Internal Grdr.
No. 16-16 Bryant Int. Grinder.
No. 16-28 Bryant Int. Grinder.
No. 16-38 Bryant Int. Gdr.
No. 24 L-36 Bryant Hyd. Int. Gdr.
No. 16 A-28 Bryant Internal Grinder.
No. 24-26 Bryant Int. Grinder.
No. 24-36 Bryant Internal Grinder.
No. 81 Heald Internal Centerless.
No. 16-36" Blanchard Vertical Surf. Grinder.
72-A5 Heald Int. Gdr. (1942).

Hill-Clarke Norton Type Motor Driven Grinders

10"x36" Centers. 14"x36" Centers.
10"x72" Centers. 14"x50" Centers.
10"x96" Centers. 14"x72" Centers.
18"x96" Centers. 14"x96" Centers.
18"-30" gap x 96" Centers.
26"x96" Norton.

Hones

Model H-2 Micromatic Horiz. Hone.
Model 200-H5-Dbl. End. Micro. Horiz.
Model H-7 Micromatic Vert. Hone, etc.
No. 224 Barnes Vert. Hone.
No. 806-H Barnes Vertical Hone.

Lathes

R-14 Lo-Swing Automaitc Lathe.
18"x6' Am. Geared Head Lathe.
27"x12' American Geared Hd. Lathe.
36"x18' Putnam Grd. Hd. M.D.

Turret Lathes

No. 5W Acme Tur. Lathe (Late).
No. 2 Warner & Swasey Geared Head.
No. 3AL Gisholt, Cross-Slide Turret.
No. 3 Warner & Swasey Turret Bar Feed.
No. 4A Warner & Swasey Turret.
No. 6 Warner & Swasey, cone head.
2¼"x24" Jones & Lamson.
18" Libby, M.D.
No. 4A Warner & Swasey (1944).

Planers

48"x36"x14' Gray, 2 Heads.
48"x48"x12' Cincinnati, 2 Heads.
60"x48"x27' American, 4 Heads.

Milling Machines

No. 08 Cincinnati Vert. (1942).
4" Taylor & Fenn Duplex Spline.
10"x48" Hanson-Whitney Thrd. Mill.
10"x60" Pratt & Whitney Thrd. Mill.
12"x102" Mod. HT Lees Bradner Thrd. Mill.
54"x30"x16' Ingersoll Slab Mill.

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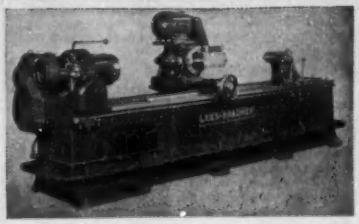
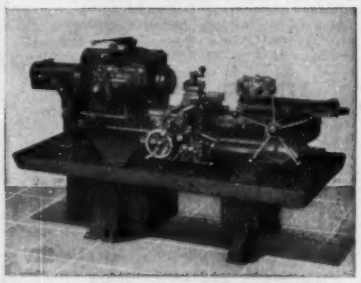


LEES BRADNER THREAD MILLING MACHINE

Model HT, 12"x102", 6" Dia Master Collet, Internal Attachment, Roller Type Steady Rest, Swing Over Ways 24". Serial HT-791.



No. 3 WARNER & SWASEY UNIVERSAL TURRET LATHE

2 Speed Motor, 220 Volt, 12 Speeds, Automatic Chuck & Bar Feed. Weight 3200 Lbs. Serial 579837.

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MIDLAND #5 Turret Lathe
OSBORNE #3 Brushing Lathe
FELLOWS #61A Gear Shaper
FELLOWS #6A Gear Shaper
VERSON 6' Power Press Brake

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Pfauter #5 Automatic Spur, Helical and Worm Gear Generator—Max. cap. 118" x 22" face—End milling attch. for herringbone gears—Feed, lead and index gears.

Gould & Eberhardt 96" x 30" Automatic Spur & Helical Gear—Auxiliary table—All power feeds—Feed, index and cutter speed gears—MD.

(4) Barber-Colman Type A Gear Hobbers—Power down feed—Single thread indexing—1947 machines.

Gleason 12" Straight Bevel Gear Generator—Max. pitch dia. 16⅞"—Hydro-screw table drive—MD—Late type.

PLANERS

Gray Double Housing—36"x36"x32'—2 rail and 2 side heads—MD.

Gray Double Housing—42"x42"x24'—2 rail and 2 side heads—MD.

Betts 15'x10'x36'—2 rail and 2 side heads—MD.

Rockford Openside Hydraulic — 24"x24"x60" — Late type—1 head on rail.

Rockford Hydraulic 66" Shaper—Planer—Power elevation to rail—Stroke 69" max.—Table 24"x80"—MD.

Cincinnati #5-42 Duplex Vertical Hydro Broach—1945 machine.

LATHES

Monarch 36"x41' ctrs. Engine—Model NN—Swing over ways 37½"—Camlock spindle—Two carriage & two taper attachments—MD—1940 machine.

Monarch 16"x30" ctrs. Engine—Model W—Swing over ways 18½"—Taper attchment—MD—Late

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INDEX OF PRODUCTS ADVERTISED IN THIS ISSUE

Abrasives, Coated 60-61, 207

Accessories & Attachments (Machine Tool) 57, 82, 106, 203, 248, 250, 270

Arbors & Mandrels 267

Balancing Machines 74

Bearings ..... 4th Cover, 239

Books, Technical 83, 234

Boring, Drilling & Milling Machines (Horizontal) ..... 3rd Cover, 14-15, 34, 271

Boring Machines Internal ..... 2nd Cover, 104-105

Boring & Turning Machines (Vertical) 96, 271

Broaching Machines 79, 153, 154

Brushes 213, 254

Cams 250

Centrifugal Machines 246

Chucks 208

Cleaning & Drying Machines & Supplies 223

Collets 91

Controls Electrical 94-95, 192, 219

Cut-Off Machines 49

Cutters, Abrasive 30-31

Dressers 86, 248

Drilling Machines ..... 54-55, 71, 78, 87, 106, 153, 187, Insert Facing 209, 247, 254

Drill Jig Bushings 85

Duplicators & Pantographs ..... 3rd Cover, 46, 112, 179, 215, 235

Electro Plating & Polishing Equipment & Supplies 196

Exhibits 242

Fabricating Methods & Services 218

Fasteners 32D, 189, 201, 267

Floor Drying Compounds 210

Gages & Instruments 16, 47, 80-81, 195, 204, 209, 220, 230, 234, 266, 268

Gear Cutting Machines 3, 6-7

Gears, Speed Reducer, Motor Reducers ..... 205, Insert Facing 208, 216, 221, 230, 271

Gear Testers 3, 6-7

Grinders—Cutter & Tool 12-13, 90, 98, 211, 250, 268, 270, 272

Grinding Machines—Production ..... 2nd Cover, 12-13, 18-19, 29, 41, 70, 76, 92, 228-229, 268, 272

Grinding Wheels 26-27, 29, 30-31, 60-61

Heads: Drilling, Grinding & Tapping 50-51, 110, 248

Heat Treating Equipment & Supplies 217, 252

Honing Machines 100

Hydraulic & Pneumatic Parts & Equipment 64, 68, 198, 226, 236

Jig Borers 269

Lapping Machines 18-19

Lathes, Automatic 22-23, 36, 62-63, 74

Lathes, Engine ..... 46, 179, 199, Insert Facing 209, 216, 244

Lathes, Turret ..... 22-23, Insert Bet 32A-32D, 74

Lubricants, Cutting Fluids, Quenching Oils & Solvents 35, 52-53, 77, 158, 181, 252

Machines, Super Finishing 74

Marking Machines, Tools & Supplies 254

Materials, Cutting & Forming 32, 37, 38-39, 40, 42, 69, 160, 212, 245, 246

Materials of Manufacture 42, 65, 83, 109, 183, 212, 237, 245, 251

Materials Handling Equipment 224

Millers, Die Sinkers, Profilers 4-5, 8-9, 20-21, 84, 215, 235, 253, 266

Motors, Electrical 72-73

Oil Purifiers 232, 246

Power Transmission 17, 231

Presses, Forging & Forming Equipment Supplies ..... 28, 32A, 49, 56, 88-89, 177, 202, Insert Facing 209, 214, 218, 222, 234, 235, 241, 243, 250, 255, 265, 269

Production, Inventory & Tool Control 194

Pumps, Circulating 208, 226

Riveting Machines 248

Rust Preventives 238

Safety & Welfare Equipment 240, 248

Saw Blades 225

Sawing Machines 248, 254

Screw Machines; Chucking Machines ..... 3rd Cover, 43, 48, Insert Bet 64-65, 104-105, 200

Shafting Flexible 50-51

Shapers, Slotters, Keyseaters 58-59, 112, 248, 250, 254

Sorting Machines 203

Special Machine Tools 4-5, 57, 62-63, 102, 153, 185, 197

Spindles, Machine 252

Stampings 206

Tapping Attachments 22-23, 50-51, 106, 110, 156

Tapping Machines 254

Thread Cutting Machines 10-11, 22-23, 193, 250

Tools, Cutting 24-25, 33, 37, 38-39, 40, 44-45, 50-51, 75, 93, 154, 156, 189, 202, 220, 230, 238, 249

Tools Hand 189, 193

Tools, Portable 236

Used & Surplus Equipment 258-263

Vises 82-198

Welding & Cutting, Brazing & Soldering Equipment & Supplies 191, 206, 227, 233, 256

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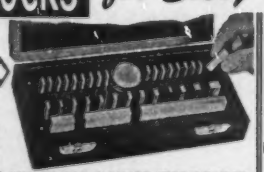

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INDEX TO ADVERTISERS

This index is pubished as a convenience to the readers. Every care is taken to make it accurate, but AMERICAN MACHINIST assumes no responsibility for errors or omissions.

	Page
Abrasive Products, Inc.	207
Acromark Company	254
Affiliated Machine & Tool Co.	248
Ajax Manufacturing Company	241
American Brass Company	65
American Chain & Cable Co., Inc.	204
American Machinist	66-67
American Optical Co.	240
American Steel Foundries, King Machine Tool Div.	96
American Tool Works	71
Ames Company, B. C.	209
Armco Steel Corporation	109
Armstrong-Blum Mfg. Co.	248
Armstrong Bros. Tool Co.	82
Arter Grinding Machine Company	268
Atlantic Refining Company	35
Atlas Press Co. (Clausing Div.) Insert Facing	209
Attapulgus Minerals & Chemicals Corp.	210
Automotive Gear Works, Inc. Insert Facing	208
Avey Drilling Machine Co.	106
Barrett Co., Leon J.	246
Besly-Wells Corporation	249
Bethlehem Steel Company	69
Bilgram Gear & Machine Company	271
Blake Co., Edward	270
Blanchard Machine Co.	70
Bound Brook Oil-Less Bearing Co.	239
Boye & Emmes Machine Tool Co.	199
Bridgeport Machines, Inc.	253
Bristol Brass Corp.	251
Brown & Sharpe Mfg. Co. Insert Bet. 64 & 65	
Bryant Chucking Grinder Co.	104-105
Buck Tool Company	208
Buffalo Forge Co.	247
Buhr Machine Tool Co.	197
Bullard Co. Insert Bet. 32A-32D	
Carboloy Dept. of General Electric Co.	37, 38-39, 40
Carborundum Company	60-61

INDEX TO ADVERTISERS

	Page
Cardinal Machine Co.	198
Carlton Machine Tool Company	87
Carroll & Jamieson Machine Tool Co.	216
Chase Brass & Copper Co., Inc.	83
Chicago Pneumatic Tool Company	236
Cincinnati-Bickford Tool Co.	78
Cincinnati Gear Co.	216
Cincinnati Milling Machine Co.	4-5
Cincinnati Milling Machine Co. Grinding Wheels Division	26-27
Cincinnati Planer Company	14-15
Cincinnati Shaper Company	58-59, 112
Clark Controller Co.	219
Cleveland Crane & Engineering Co.	243
Cleveland Welding Co.	191
Climax Molybdenum Co. of New York	252
Colonial Broach Company	79
Columbia Div. Lodge & Shipley Co.	49
Columbia Tool Steel Company	246
Columbus Die-Tool & Machine Co.	218
Cone Automatic Machine Co.	43
Covel Manufacturing Company	41
Crucible Steel Co. of America	32
Dake Engine Co.	269
Davis & Thompson Co.	271
Davis Keyseater Company	250
DeLaval Separator Company	232
Delta Power Tool Div. Rockwell Mfg. Co. Drill Head Unit	211
Denison Engineering Company	177
Detroit Power Screwdriver Co.	203
Eastern Machine Screw Corporation	248
Eastman Kodak Co., Special Products Sales Div.	195
Edlund Machinery Company	254
Eisler Engineering Co., Inc.	250
Elastic-Stop Nut Corp.	201
Erie Foundry Company	214
Ex-Cell-O Corporation	98
Federal Machine & Welder Co.	256
Fellows Gear Shaper Company	6-7
Foote-Burt Company	153
Fosdick Machine Tool Company	54-55

(*Continued on page* 268)

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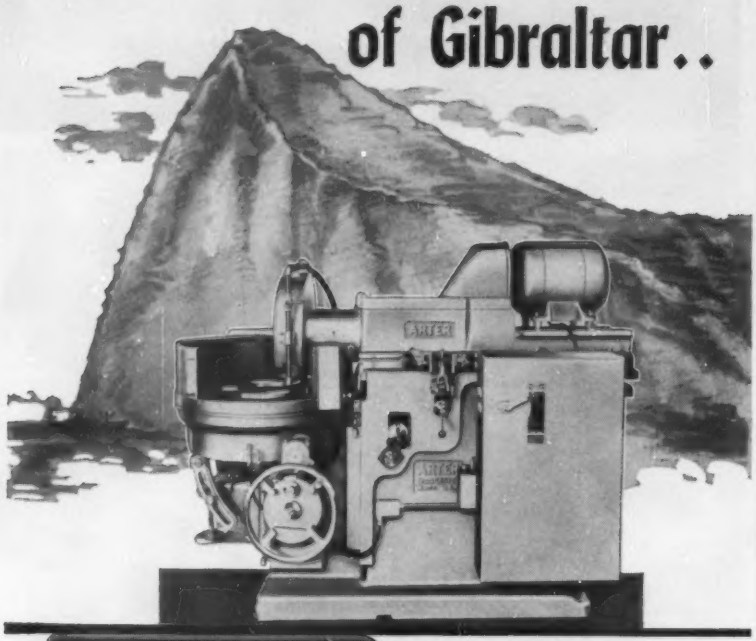

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INDEX TO ADVERTISERS

(*Continued from page 267*)

	Page
Fourth European Machine Tool Exhibition	242
Frauenthal Div. Kaydon Engineering Corp.	228-229
Gallmeyer & Livingston Co.	272
Gardner Machine Co.	29
Gemco Shaper Co.	248
General Electric Apparatus Dept.	94-95
Gerotor May Corporation	226
Giddings & Lewis Machine Tool Co.	14-15
Gisholt Machine Company	74
Gleason Works	3
Gorham Tool Co.	93
Gorton Machine Co., George	215
Goss & DeLeeuw Machine Company	200
Grant Gear Works, Inc.	230
Grant Mfg. & Machine Company	248
Grob Brothers	254
Hardinge Brothers, Inc.	91
Haynes Stellite Co., Div. Union Carbide & Carbon Co.	245
Heald Machine Company	2nd Cover
Heller Machine Co.	34
Henry & Wright Div. Emhart Mfg. Co.	56
Hones, Inc., Charles A.	252
J & S Tool Company	86
Jarvis Co., Charles L.	50-51
Johnson & Bassett, Inc.	235
Jones & Lamson Machine Company	36, 47
Kearney & Trecker Corp.	20-21
Kempsmith Machine Company	84
King Machine Tool Div. American Steel Foundries	96
Knight Machinery Co., W. B.	266
Lamina Dies & Tools Inc.	234
Laminated Shim Co., Inc.	206
Landis Machine Company	10-11
Landis Tool Co.	12-13
Leland-Gifford Company	187
Lincoln Electric Company	206
Lincoln Park Industries Inc.	196

INDEX TO ADVERTISERS

	Page
Linde Air Products Div. Union Carbide Corp.	217
Link-Belt Co.	17
Linley Brothers Co.	269
Lodge & Shipley Company	46
Logansport Machine Company, Inc.	68
Luers, J. Milton	250
M.B.I. Export & Import Ltd.	267
Mallory & Co., Inc., P. R.	233
Manheim Mfg. & Belting Company	231
Massachusetts Gear & Tool Co.	221
Mathieson Chemical Corp.	227
Mattison Machine Works	76
McCaskey Register Div. Victor Adding Machine Company	194
McGraw-Hill Book Co., Inc.	234
McKay Machine Co.	222
Micromatic Hone Corp.	100
Minstér Machine Company	88-89
Mitts & Merrill	254
Morse Twist Drill & Machine Co.	24-25
Motch & Merryweather Machinery Co.	102
National Acme Company	48
National Broach & Machine Co.	154
National Machine Tool Company	220
National Tool Company	33
National Twist Drill & Tool Co.	45
New Britain Machine Company	3rd Cover
Nicholson & Company, W. H.	198
Norton Company	18-19, 30-31
Oakite Products Inc.	223
Oliver Instrument Company	90
O'Neil-Irwin Mfg. Co.	202
Osborn Mfg. Co.	213
Ottemiller Co., Wm. H.	267
Perfex Gage & Tool Co.	220
Philadelphia Gear Works	205
Pittsburgh Plate Glass Co. Brush Div.	254
Plough Inc.	250
Production Specialties Inc.	238

(*Continued on page* 270)

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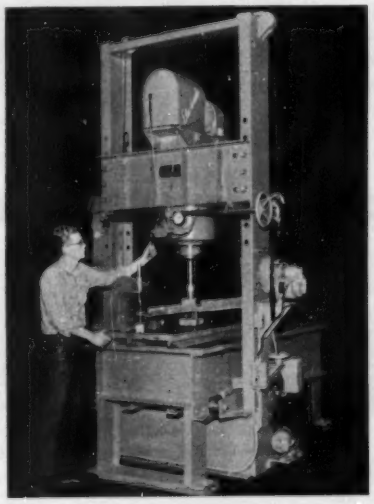

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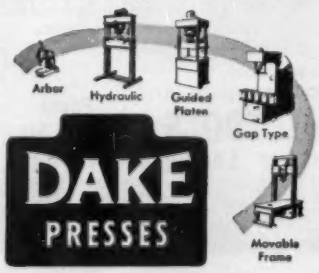

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INDEX TO ADVERTISERS

(*Continued from page* 269)

	Page
Reich, Mfg. Co., J. R.	248
Reid Brothers Co., Inc.	92
Republic Steel Corp.	237
Revere Copper & Brass Inc.	183
Ridge Tool Company	193
Rodgers Hydraulic Inc.	255
Ruthman Machinery Company	208
Ryerson & Sons Inc., Joseph T.	160
Sales Service Machine Tool Co.	250
Scherr Optical Tools Inc., George	230
Scherr Co., Inc., George	234, 266
Sheffield Corp.	110
Shore Instrument & Mfg. Co., Inc.	268
Sidney Machine Tool Company	179
Snyder Tool & Engineering Co.	185
Socony Vacuum Oil Co., Inc.	181
Speedi-Dri Corp.	210
Square D Co.	192
Standard Electrical Tool Co.	252
Standard Oil Co. (Indiana)	52-53
Standard Pressed Steel Co.	32D
Standard Tool Co.	75
Steelweld Machinery Div. Cleveland Crane & Engineering Co.	243
Stuart Oil Co., Ltd., D. A.	77
Sundstrand Machine Tool Company	62-63
Sun Oil Company	158
Swartz Tool Products Div. of Jefferson Corp.	57
Taft-Peirce Mfg. Company	80-81
Thompson & Son Co., Henry G.	225
Timken Roller Bearing Co.	4th Cover
Towmotor Corp.	224
Union Carbide & Carbon Corp.	217, 245
U. S. Industrial Tools	270
U. S. Steel Supply Div. U. S. Steel Corp.	42
Universal Engineering Corp.	85
V & O Press Company Div. Emhart Mfg. Co.	32A
Vaill Engineering Company	235
Van Keuren Co.	16
Van Norman Company	8-9
Vickers Inc.	64

INDEX TO ADVERTISERS

	Page
Wade Tool Co.	244
Waldes Koh-I-Noor Inc.	189
Waltham Machine Works	265
Warner & Swasey Company	22-23
Weldon Tool Company	250
Westinghouse Electric Corp.	72-73
Wheelock Lovejoy & Co., Inc.	212
Whitman & Barnes Inc.	238
Wickman Manufacturing Company	156
Willey's Carbide Tool Co.	230
Wilson Co., K. R.	28
Wilson Mechanical Instrument Co.	204
Winter Brothers Company	44
Woodruff & Stokes	202

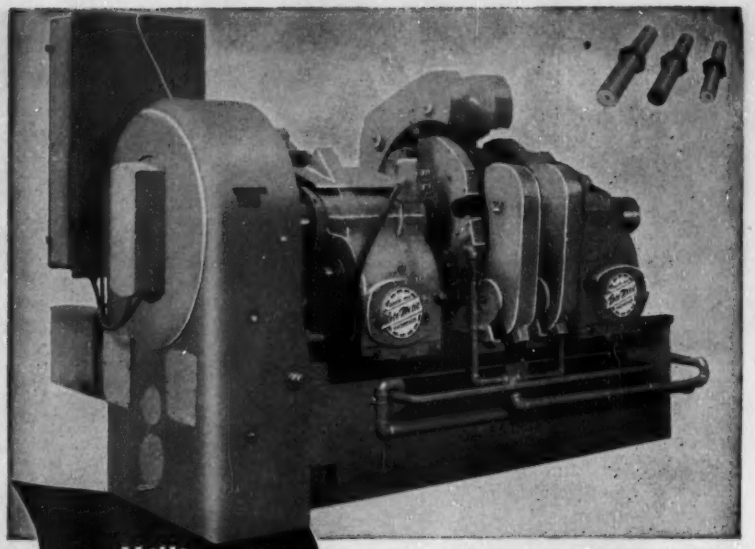
SEARCHLIGHT SECTION
(Classified Advertising)

H. E. Hilty, Mgr.

	Page
EMPLOYMENT	
Position Vacant	257
Selling Opportunities Offered	257
Employment Services	257
SPECIAL SERVICES	
Contract Work	257 & 264
General Pattern Works	264
Lancaster Metal Products Co.	264
O.K. Tool Co., Inc.	264
Tilp, Inc., J. G.	264
Rebuilding	262
EDUCATIONAL	
Books	257
EQUIPMENT (Used or Surplus New)	
For Sale	258-264
WANTED	
Equipment	257

ADVERTISERS INDEX

Aaron Machinery Co., Inc.	260
Bennett Machinery Co.	258
Botwinik Bros. of Mass. Inc.	264
Brownell Machine Tools Inc., Hazard	264
Currier Machine Sales	258
Dony Machinery Co.	258
Eastern Machinery Co., The	261
Electric Equipment Co.	260
Falk Mill Supply Co., Inc.	259
General Pattern Works	264
Hill-Clarke Machinery Co.	263
Hyman & Sons, Jos.	263, 264
Indianapolis Machinery & Supply Co.	262
Judson Research & Mfg. Co.	263
Lagoe Oswego Corp.	262
Machine Tool Publications	257
Miles Machinery Co.	258
M & N Hydraulic Press Corp.	258
National Cooperage Co.	260
National Machinery Exchange	264
O'Brien, Clarence J.	260
O'Connell Machinery Co.	258
O. K. Tool Co., The	264
Peacock Corp.	257
Springfield Auction Co.	263
Tilp, Inc., J. G.	264
Triplex Machine Tool Corp.	262
United Machinery & Tool Corp.	260
Wigglesworth Industrial Corp.	260
Williams, Edward Hale	263



Milling and Centering Simultaneously and in Continuous Production

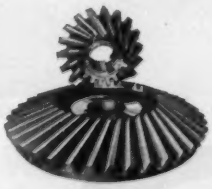
Here's an excellent example of how two entirely different operations can be combined on one machine. This Davis and Thompson continuous type Roto-Matic both mills and centers on both ends in one operation. Rough and finish milling cuts on the ends of the shaft and centering of both ends is completed with only one rotation of the fixture drum. The centering heads travel with the work station until centering operation is complete then drop back to next work station and repeat. Automatic equalizing clamping is provided to the fixture. Spindles have micrometric adjustment and spindle carriers are adjustable on the ways to accommodate shafts of various lengths.

FREE DATA on this and other Davis and Thompson machines is available in our bulletin No. 1000.

Roto-Matic

Davis and Thompson Co.

4460 N. 124th ST. MILWAUKEE 16, WISCONSIN



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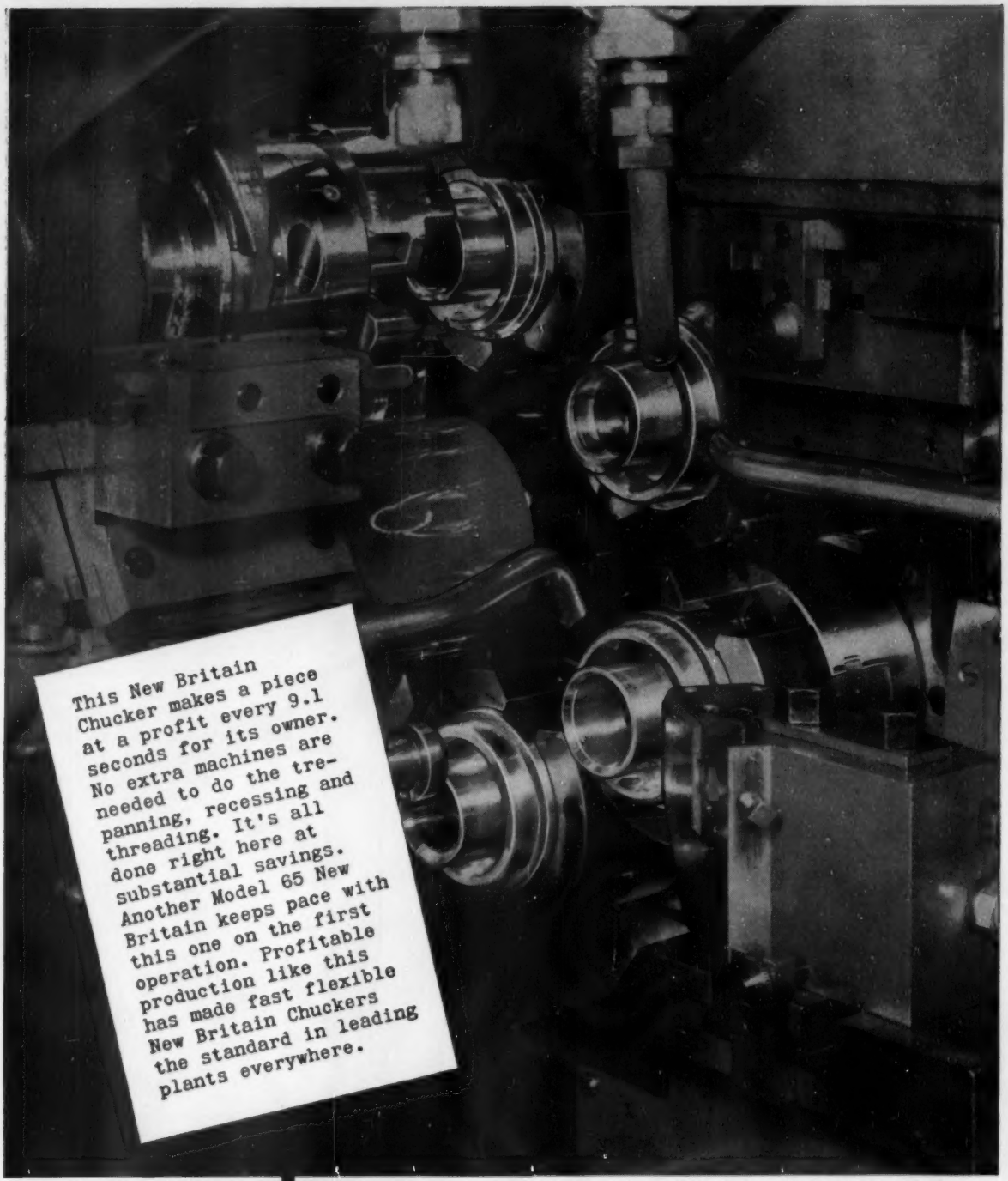
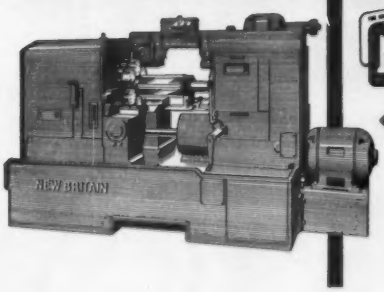


Our general catalog is filed in the Sweet's Machine Tool Catalog File.



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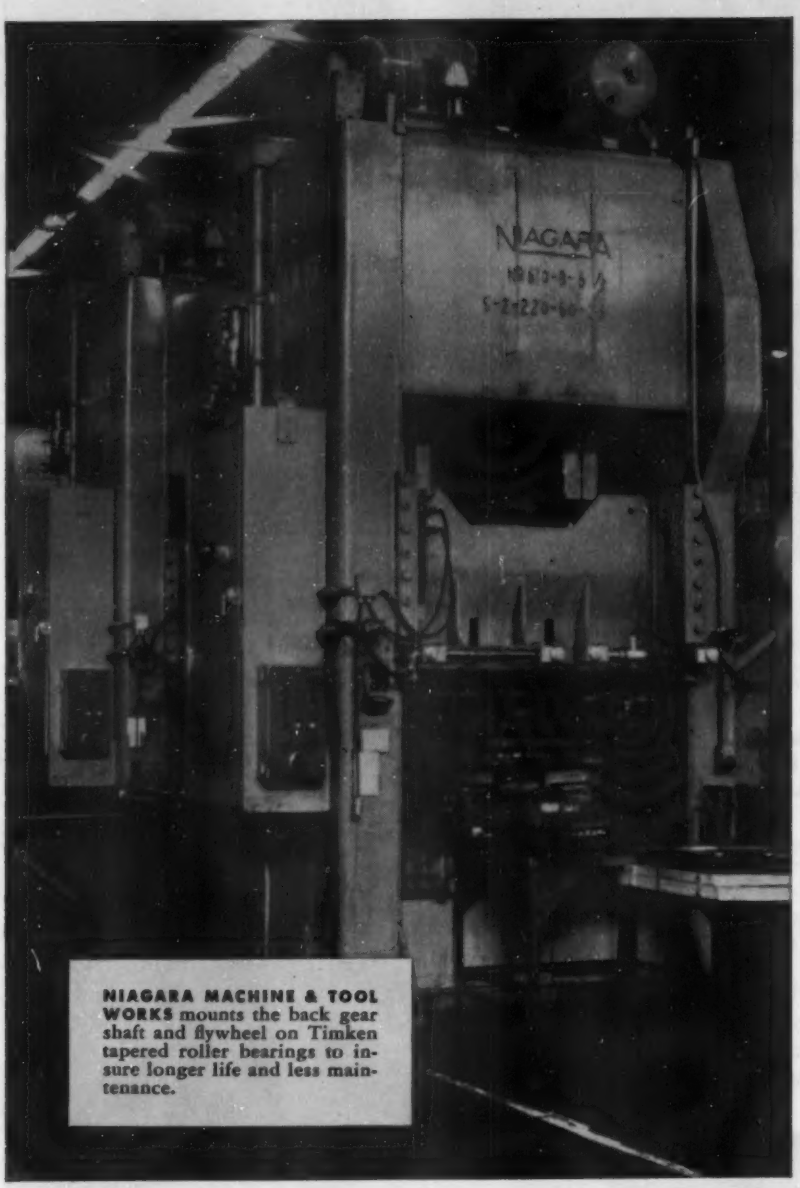
NEW BRITAIN *Automatics*

How TIMKEN® bearings cut maintenance on auto body stamping presses



NIAGARA MACHINE & TOOL WORKS mounts the back gear shaft and flywheel on Timken tapered roller bearings to insure longer life and less maintenance.

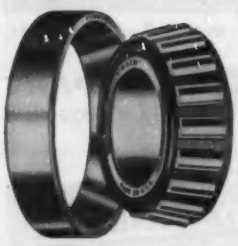
MAINTENANCE and downtime are low in the stamping department of one large automotive manufacturer. One reason: 30 new-design Niagara double crank presses have the back gear shaft and flywheel on Timken® tapered roller bearings.

Every time the press stamps a part, the bearings on the back gear shaft take the heavy shock load. Timken bearings take these loads with ease because rollers and races are case-hardened. This gives them a hard, wear-resistant surface over a tough, shock-resistant core. Full line contact between rollers and races of Timken bearings gives them extra load carrying capacity to hold shafts in line. There's minimum maintenance, less downtime.

Timken bearings help gears last longer, too. They insure accurate gear mesh because Timken bearings' tapered construction lets them take both radial and thrust loads in any combination. The taper prevents lateral movement of the shaft. Flywheels do not become worn or loose, crankshaft wear is prevented.

Be sure to specify Timken bearings for all the machinery you build or buy. They give longer life with less friction. Look for the trade-mark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, O. Canadian plant: St. Thomas, Ont. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



TIMKEN

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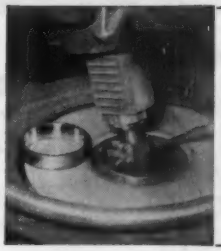
TAPERED ROLLER BEARINGS



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Finishing to incredible smoothness accounts for much of the precise, smooth rolling performance of Timken bearings. This honing operation is typical of the amazingly accurate manufacturing methods at the Timken Company.

The Timken Company is the acknowledged leader in: 1. advanced design; 2. precision manufacturing; 3. rigid quality control; 4. special analysis steels.

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